# THE IMPACT OF FOOD AID ON MAIZE PRODUCTION IN SWAZILAND

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**Submitted in partial fulfillment of the**
**degree of MAgric (Food Security)**

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**2007**

**ABSTRACT**

The objective of the study was to provide empirical evidence on whether food aid leads to depressed domestic maize prices and reduced maize production in subsequent years in Swaziland. Similar impact studies have been carried out in a number of sub-Saharan African countries but no evidence is available for Swaziland. The lack of empirical evidence has often resulted in premature negative conclusions on the impact of food aid on Swaziland's maize industry.

The study used secondary national data from 1985 to 2006 to analyse the impact of food aid on maize producer prices and quantity of maize produced. Variables used in the analysis included quantity of cereal food aid; quantity of commercial maize imports; quantity of locally produced maize; official maize producer price; open market maize producer price; fertilizer price; fuel price; rainfall; and total area planted to maize. The impact of food aid was measured using the reduced form market equilibrium model that consisted of maize quantity and maize producer price functions estimated simultaneously using the above variables through the two-stage least square method (2SLS) method.

Analytical results revealed that food aid to Swaziland does not lower prices of domestic maize and has no significant negative effect on the quantity of maize produced in subsequent seasons. This means that food aid received by Swaziland over the study years has been appropriately targeted and distributed to the food insecure households. If this were not so, the demand for food from commercial outlets would have been reduced, leading to an adverse impact on maize producer prices, and subsequent local maize production.

Notwithstanding the above results, Swaziland should still commit resources towards reducing the national food gap. This calls for increased investment in rural irrigation development, improved farmer institutional support services, and the implementation of pro-poor development programs aimed at improving individual household income to

reduce the need for food aid, improve food self-sufficiency and vulnerability to food security.

# DECLARATION

I, Majola Lawrence Mabuza declare that:

(i) The research reported in this dissertation, except where otherwise indicated, is my original research.

(ii) This dissertation has not been submitted for any degree or examination at any other university.

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Signed:___________________________ Date:___________________

Majola Lawrence Mabuza

As Research Supervisor, I agree to the submission of this dissertation for examination.

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Prof. S.L. Hendriks

As Research Co-supervisor, I agree to the submission of this dissertation for examination.

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Dr M.M. Sithole

# ACKNOWLEDGEMENTS

Acknowledgement is gratefully expressed for the assistance and co-operation of the following people, who helped make this study possible.

Prof. Sheryl Hendriks (Director of the African Centre for Food Security, University of KwaZulu-Natal), for her constant guidance, supervision and encouragement.

Prof. Gerald Ortmann (Professor of Agricultural Economics, University of KwaZulu-Natal), for the dedication and commitment he exhibited in ensuring that the research was of high quality.

Dr Moses. M. Sithole (Senior Lecturer in the Faculty of Agriculture, University of Swaziland), for his unreserved support and guidance in conducting the research analysis.

Dr Prince Ndlovu (Senior Lecturer in the Department of Statistics, University of KwaZulu-Natal), for his informative comments on the research methodology and results.

The Ministry of Agriculture and Co-operatives, Ministry of Natural Resources and Energy, Central Statistics Office, Farm Chemicals, Swaziland Meteorological Service, National Maize Corporation, Food and Agriculture Organisation (FAO) and World Food Programme (WFP), for their support in providing data and information used in the analysis.

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# CHAPTER 1

# STATEMENT OF THE PROBLEM

## 1.1 Introduction and background

While food aid has served a valuable function in saving lives in times of disaster, when normal food supply channels are disrupted, it has in many cases, had undesirable consequences by impacting on local markets in developing economies where it has continued to be distributed beyond transitory shortfalls in domestic food availability (Ingco *et al*, 2003; Barrett, 2002). Issues concerned with the resultant effects of food aid have been debated and analysed since the early 1960's by numerous researchers without definite conclusions on how food aid affects agricultural production (Tapio-Bistrom, 2001; Gilligan *et al*, 2005).

Although food aid is declining globally, it continues to constitute an important part of overall donor assistance to southern Africa. There has been a significant shift, both globally and regionally, away from programme food aid, with nearly two thirds of all food aid now being used for emergency assistance (Maunder *et al*, 2006). While relatively little food aid was provided to southern Africa in the early and late 1990's, a substantial food aid response was made in the 2001 – 2003 emergency that was caused by drought. Food aid flows have led to protests about disincentive effects by producers, traders and other stakeholders in the agricultural sector (SADC, 2005).

During the 2002-2005 production seasons, cereal food aid played a major role in filling Swaziland's maize gap following Government's appeal to the international community to assist with the impact of the 2001/02 and successive droughts coupled with erratic rains. The availability of emergency food aid in Swaziland saw the National Maize Corporation (NMC) being unable to buy maize from local farmers in 2002 - 2004 since the Corporation's silos remained full with maize from previous seasons. The NMC experienced difficulties in selling maize to millers who also could not sell maize meal to retailers as people were no longer buying maize meal as they were recieving food aid, including maize from donor agencies.

## 1.2 Research justification

Considering the extent of alleged negative effects of food aid on domestic agricultural production, this study explores empirical evidence to identify the benefits and disadvantages of food aid with regards to the Swaziland maize industry. Similar studies have been carried out for sub-Saharan Africa by the International Food and Policy Research Institute (Abdulai et al, 2004), World Bank (Lavy, 1990), Regional Hunger and Vulnerability Programme (Maunder, 2006) and Lowder (2004), but no evidence is available specifically for Swaziland. The lack of evidence often results in premature negative conclusions on the impact of food aid on the country's maize industry. Stakeholders in Swaziland's maize industry have been involved in lengthy discussions on the food aid subject and have agreed on the necessity to avail empirical evidence that will confirm the distortions allegedly caused by food aid. The outcome of the study will contribute towards the development of short and long-term policies aimed at fostering sustainable food security in the country.

## 1.3 Problem statement

Do large quantities of imported food aid raise aggregate maize supplies on Swaziland domestic markets leading to depressed domestic maize prices and reduced maize production quantities?

## 1.4 Sub problems

1.4.1 Does food aid lead to lower prices in the Swaziland domestic maize market?

1.4.2 Does food aid act as a disincentive to local maize producers such that the level of production in Swaziland is reduced in subsequent seasons?

## 1.5 Hypothesis

Food aid causes a reduction in local maize producer price and leads to reduced quantities of local maize produced.

## 1.6 Study limits

The study concentrates only on national level effects of food aid. While there may be other impacts at household level, these are beyond the scope of this study. Another limitation is the unavailability of data for some variables in the econometric model employed for analyzing the impact of food aid on maize production, necessitating the use of dummy variables, proxy variables and average costs to account for weather, transport costs and fertilizer costs, respectively. The unavailability of data from a number of local institutions has also forced the study to use data between 1985 and 2006 and this has affected the degrees of freedom. However, studies that have used similar methodologies were able to produce satisfactory results using data sets for 25 years (Tapio-Bistrom, 2001), 17 years (Lavy, 1990) and 11 years (Demeke *et al*, 2004), respectively. Another limitation is the use of annual data, which concentrates on medium term impacts between cropping seasons rather than intra-seasonal or short term impacts.

## 1.7 Outline of the dissertation

The dissertation contains six chapters. Chapter one has presented the introduction, motivation for the study, problem statement, sub-problems and study limits. Chapter two introduces the Swaziland maize industry, presenting in particular the importance of maize as a commodity to the Swazi people. Chapter three begins by reviewing literature of related food aid studies and the impact of food aid on maize production. Chapter three also reviews literature on the effect of food aid on agriculture and looks at quantitative methodologies that have been used to study the impact of food aid on local agricultural production. Chapter four outlines the research methodology used, and chapter five presents analytical results. Chapter six presents the study conclusions and recommendations that may be adopted to ensure that food aid contributes positively towards the attainment of national food security.

# CHAPTER 2

# THE MAIZE INDUSTRY IN SWAZILAND

## 2.1 Introduction

This chapter introduces the Swaziland maize industry, presenting in particular, the importance of maize as a commodity to the Swazi people. The chapter is divided into four sub sections looking at maize production, marketing and consumption and the coordination of food aid in the country.

## 2.2 Maize production

Maize is the staple food of Swaziland and it is the main crop grown by the vast majority of smallholder farmers, largely for subsistence purposes. Maize is the most predominant crop grown on Swazi Nation Land (SNL), covering 80% of the total area under crop production (FANRPAN, 2003). Most maize in Swaziland is produced in the Middleveld, which produces 45%; followed by the Highveld, with 28% production, the Lowveld with 23% and the Lubombo Plateau with 4% (Government of Swaziland, 2004). Most production of maize takes place on SNL, where the average land holdings are 1.7 ha per farmer (United Nations Development Programme, 2005). Despite the favourable agro-ecological conditions for maize production over much of the country, maize production in recent years has declined as, illustrated in Table 1.

Food self sufficiency in terms of maize production has been below 60% since the year 2000, when the country experienced the onset of a five-year drought.

**Table 1: Maize production, consumption, imports, food aid and prices in Swaziland (1984/85 – 2005/06)**

| Year | Maize production (tons) | Consumption (tons) | Self sufficiency % | Area under maize production (ha) | Commercial maize imports (MT) | Cereal food aid (MT) | Open maize price (E/ton) | Official maize price (E/ton) |
|---|---|---|---|---|---|---|---|---|
| 1984/85 | 85,000 | | | 82,553 | 24000 | 607 | 260.00 | 211.10 |
| 1985/86 | 85,000 | | | 80,561 | 21484 | 3049 | 318.57 | 308.57 |
| 1986/87 | 91,000 | | | 63,582 | 6974 | 7893 | 351.71 | 322.43 |
| 1987/88 | 89,000 | 143,845 | 62 | 80,340 | 27457 | 10028 | 401.00 | 336.86 |
| 1988/89 | 123,196 | 141,058 | 87 | 84,371 | 32060 | 2541 | 457.14 | 352.14 |
| 1989/90 | 84,371 | 104,064 | 81 | 97,433 | 16020 | 4841 | 521.14 | 367.86 |
| 1990/91 | 94,173 | 101,539 | 93 | 83,982 | 10770 | 2708 | 585.71 | 385.71 |
| 1991/92 | 53,927 | 122,920 | 44 | 57,330 | 9917 | 14975 | 592.86 | 428.40 |
| 1992/93 | 84,519 | 123,671 | 68 | 63,563 | 37072 | 24599 | 928.57 | 500.00 |
| 1993/94 | 76,195 | 94,215 | 81 | 61,585 | 5745 | 9766 | 928.57 | 715.14 |
| 1994/95 | 76,052 | 113,357 | 67 | 59,726 | 10352 | 6150 | 785.72 | 610.00 |
| 1995/96 | 135,627 | 159,390 | 85 | 67,447 | 23562 | 9500 | 785.72 | 610.00 |
| 1996/97 | 108,207 | 133,114 | 81 | 60,905 | 6767 | 0 | 714.29 | 607.14 |
| 1997/98 | 125,204 | 131,900 | 95 | 65,149 | 10106 | 5000 | 714.29 | 607.14 |
| 1998/99 | 107,340 | 125,500 | 86 | 61,051 | 30760 | 5000 | 1,214.29 | 624.86 |
| 1999/00 | 112,779 | 139,000 | 81 | 76,210 | 24812 | 0 | 1,142.86 | 650.00 |
| 2000/01 | 82,536 | 155,700 | 53 | 64,116 | 34911 | 0 | 1,071.43 | 700.00 |
| 2001/02 | 67,639 | 156,700 | 43 | 60,133 | 41307 | 15531 | 1,714.29 | 750.00 |
| 2002/03 | 69,273 | 133,500 | 52 | 67,682 | 24324 | 24200 | 2,000.00 | 750.00 |
| 2003/04 | 66,862 | 118,000 | 57 | 54,470 | 18641 | 12900 | 2,428.57 | 750.00 |
| 2004/05 | 74,540 | 118,500 | 63 | 56,265 | 18378 | 12100 | 2,428.57 | 950.00 |
| 2005/06 | 69,210 | 121,000 | 57 | 56,265 | 21000 | 9710 | 2,428.57 | 950.00 |

**Source:** NMC (2005)

The typical seasonal activities for rain-fed maize production in Swaziland begin with land preparation during August and September, followed by planting up to the end of November. Weeding is required from December to March to ensure good growth of the young crop. Farmers also use this time to prepare on-farm storage facilities for the maize harvest. After calculating home consumption requirements, any remaining surplus maize is marketed. Harvest times vary by region, with the earliest maize being harvested in the Lowveld during March to April. With good drying conditions, maize can be marketed from the end of March. The bulk of maize is harvested during May to July, and marketed from July through to November.

### 2.2.1 Maize production by land tenure system

Of the total population of approximately 1 million, 80% of the people of Swaziland live in rural areas and practice agriculture (GoS, 2005a). Agricultural production is divided between two distinct categories of land tenure. SNL accounts for almost 80% of the country's total agricultural land area and approximately 70% of the population reside on SNL holdings (FANRPAN, 2003). This is land held in trust by the King on behalf of the nation, and allocated to households through Chiefs.

Production on SNL is characterised by low-input, rainfed agriculture. Subsistence food production dominates with maize being the major crop, accounting 90% of domestic maize production (FANRPAN, 2003). Most SNL households supplement their income with off-farm wages.

Commercialisation of agriculture on SNL is hindered by the land tenure system which does not confer legal ownership of land to farmers. Not only does this cause uncertainty over security of tenure, but also prevents farmers from using land as collateral to borrow capital. The other form of land tenure is Title Deed Land (TDL), which is land that is owned on a freehold basis. Title Deed Land farms are oriented towards commercial production and are characterised by large-scale, capital intensive enterprises, consisting mainly of sugarcane, cotton, citrus and pineapple. According to Central Statistics Office (2005), maize production on TDL accounts for only 5-10% of total maize production.

## 2.3 Maize storage and marketing

After maize has been harvested, households store their food requirements for own consumption. Any surplus is sold to the National Maize Corporation (NMC) or through the informal sector. Since the current maize policy framework sets a constant buying price throughout the year, there is no incentive for producers to store maize until the pre-harvest period. This creates a large influx of maize into NMC silos during a short period from May to August, with few supplies of maize during other months.

Approximately 80% of rural households have on-farm storage facilities. The favoured method of storage is in corrugated metal tanks (80%), maize cribs (15%), concrete tanks (3%), and under ground (2%) (Oxford, 1998). The NMC operates five silos with the largest silo located at Matsapha, providing a central storage facility near the main milling company. The four other silos are located around the country and bulk small quantities of maize from local farmers ready for delivery to Matsapha. No grading system is applied on maize delivered other than a check for moisture content and a visual inspection to check for non-maize contents and broken grain.

### 2.3.1 The National Maize Corporation

The National Maize Corporation (NMC) is a state owned enterprise. The corporation was established in 1985 in accordance with the Companies Act of 1912 and, unlike most parastatals, there is no special Act of Parliament that incorporates it. Its two major shareholders are the Ministry of Agriculture and Cooperatives and the National Agricultural Marketing Board (NAMBoard). The corporation is presently involved in the business of commodity trading in white maize. It receives no annual subvention from Government and generates enough income to cover its running costs (NMC, 2005).

The NMC was established with the objective of guaranteeing a market to local maize farmers at competitive prices and providing good quality maize meal at reasonable prices. These objectives, however, were changed in 1995 when NMC aborted maize milling, and concentrated only on maize purchase, storage and marketing.

The corporation has now been, *inter alia*, entrusted with the following key responsibilities (NMC, 2002):

- To guarantee an all year round competitive market for Swazi maize farmers.
- To reduce marketing barriers and costs to Swazi farmers by improving maize marketing and logistics services (through running national silos efficiently, registration of producers, provision of drying and shelling services, and provision of price information).
- To guarantee all year round supplies of maize at reasonable costs to the nation.
- To increase the efficiency of the maize industry in Swaziland by promoting the availability of white maize to consumers at reasonable costs in all regions of the country.

### 2.3.2 Maize prices

There are predominantly two prices of maize in the Swaziland maize industry. As shown in Figure 1, the official maize market price that is set by NMC, has over the years remained lower than prices in the informal sector. Apart from being reported by the National Early Warning Unit of the Ministry of Agriculture and Cooperatives, data on open market maize prices are not formally documented. However, indications show that the open market prices are generally 25 – 30% higher than the NMC buying price (Oxford, 1998).

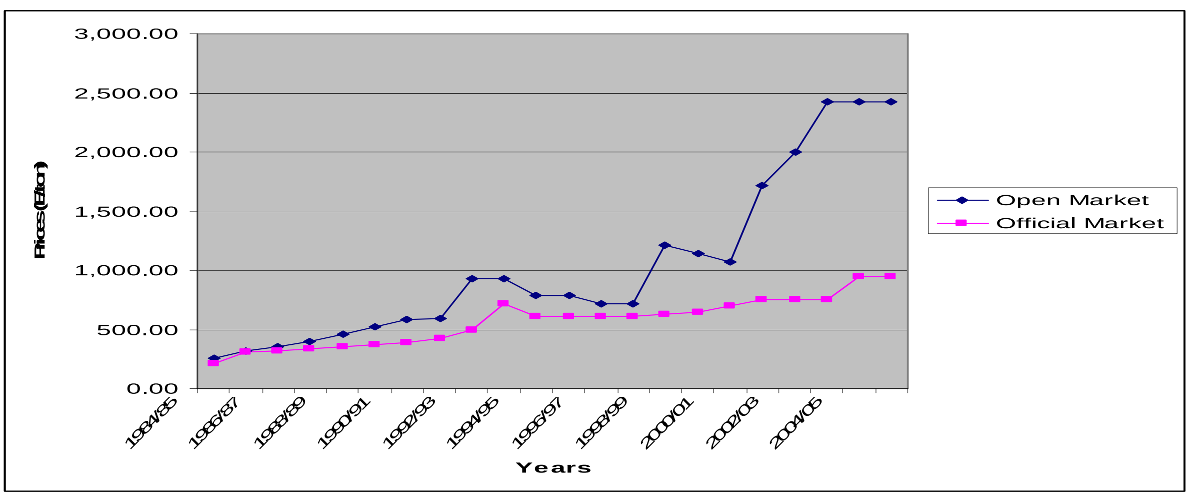



**Figure 1: Official market and open market maize prices, 1984/85 – 2005/06 (NMC, 2006; National Early Warning Unit annual bulletins).**

The drought spell currently experienced in southern Africa has impacted on maize prices. Since 2000, maize prices have increased due to a shortage of white maize in the region as a result of the drought and a decrease in the total area planted to maize (FANRPAN, 2003). The NMC also imports relatively expensive maize, and being the sole importer of maize in the country, the importing price has influenced the local price of maize (FANRPAN, 2003).

### 2.3.3 Maize policy and market interventions

Since independence (1968), Swaziland Government's intervention in the maize sector has been aimed at increasing self-sufficiency in production of the country's staple food (Oxford, 1998). This policy has involved interventions to control the marketing, milling and importation of maize, and implementation of a guaranteed minimum price for producers. The Ministry of Agriculture and Cooperatives also provides farmer services to promote maize production. Since 1995, Government began a series of policy and institutional reform under the Maize Marketing Improvement Project (MMIP). The MMIP has resulted in the following reform (Oxford, 1998):

- Withdrawal of Government from maize milling through the termination of NMC's lease with the Swaziland Milling Company;
- Restructuring the NMC to become an impartial maize purchasing, handling and storage company;
- Transfer of ownership and responsibility for the operation and maintenance of Government silos from the Ministry of Agriculture and Cooperatives' grain section to NMC; and
- Rehabilitation and expansion of the silo capacity at Matsapa from 12, 000 to 20, 000 MT.

In 1998, the Ministry of Agriculture and Cooperatives engaged Oxford Policy Management (OPM) to review the role, functions and ownership structure of NMC. The consultant advocated for complete liberalisation of Swaziland's trade in maize and maize meal. The consultants saw no value in protecting the local maize industry, because it is so small, and the controls serve only to inflate food prices.

The OPM also recommended that Government should remove NMC's monopoly on the importation of maize and maize meal and that there should be a low or zero levy on imports of maize and maize meal. These recommendations were accepted by Government but have still not been implemented.

### 2.3.4 Maize import controls

The framework of import controls that sustains the maize policy is operated by the National Agricultural Marketing Board (NAMBoard), which was established by the National Agricultural Marketing Board Act of 1985. To date, the NMC remains the sole importer of maize grain. Imports of maize products are generally not permitted, although with cheaper and superior quality maize meal available in South Africa, unofficial imports occur. Import permits are issued to institutions importing food aid. The NAMBoard sets import levies every year on all scheduled products that include maize and maize products. FANRPAN (2003) mentions that NAMBoard often has no formula to determine the maize levy, hence levies have often been arbitrarily set.

### 2.3.5 Price policy

The Government of Swaziland uses the gazetted floor price as a tool to encourage farmers to produce maize with a view to reducing the need to import the staple food crop. The floor price serves as a safety net in that if farmers cannot find a better price offer elsewhere, they are assured of the minimum price that they are entitled to get for their harvest, hence it also serves as a price stabilisation instrument. This price is mainly based on the cost of bringing maize into Swaziland (import parity) plus a small compensation for the relatively higher production costs in the country (NMC, 2005). However, the NMC also pays cartage allowances for those farmers who deliver more than five tons of maize directly to the Matsapha central depot. The floor price is normally applied to maize with a maximum moisture content of 12.5%. However, maize with a moisture content of up 18% is normally accepted, subject to *pro rata* mass loss deductions and drying charges.

The flaw in this policy is that the floor price is mainly based on local maize production costs and import parity, and not export parity. This makes it difficult for the corporation to export maize, especially during times when there is a glut in the domestic market (NMC, 2005).

### 2.3.6 Farmer services

Through the Ministry of Agriculture and Cooperatives, Government provides both research and extension services to promote maize production, among other agricultural activities. Maize research focuses on screening new varieties for their suitability to local growing conditions and pest and disease resistance. Seed trials are usually carried out in the Highveld and Lowveld areas. Only drought resistant varieties are tested in the Lowveld. Work is also carried out on the re-introduction of open pollinated maize varieties, which are seen as potentially attractive to low-income subsistence farmers.

Extension advice is provided through subject matter specialists, while the Grain Storage Section provides advice on post-harvest treatment and storage techniques. Maize market information is mainly provided by the NMC.

## 2.4 Consumption of maize

Maize has traditionally, and remains, the staple food in Swaziland. It is estimated that maize provides 64% of the average per capita energy intake (FANRPAN, 2003). Other cereals consumed are wheat and rice, accounting for 10% and one percent of energy intake respectively (Oxford, 1998). Neither of these grains is produced in Swaziland in significant quantities and at present the economic prospects for domestic production are unexploited.

The level of maize production is dependent upon rainfall and vulnerability to drought means that much of the population remains inherently food insecure. In recent years, most people living in the drought stricken areas of the Lowveld, dry Middleveld and Lubombo Plateau have survived on emergency food relief programs such as food aid.

## 2.5 Constraints in maize production

As any other industry has its own constraints, FANRPAN (2003) summarised the constraints of producing maize in Swaziland as follows:

- The average size of landholding on SNL is 1.7 ha, and land continues to be fragmented into even smaller units with time due to population growth. This limits the area on which maize and other crops can be produced.

- Rain has become very erratic with prolonged dry spells. This limits soil moisture and seriously affects maize yields.

- Soil acidity or low pH reduces the availability of nutrients in the soil and causes root stunting.
- The supply of draft power on SNL often cannot meet the demand for tractors immediately after receiving rains due to production being rain-dependent.

- The escalating cost of production, mainly of fertiliser and seed, limits adequate application of fertiliser and seed, leading to reduced maize yields. Since land is finite and land holdings are small, the only option to increase production lies in increasing productivity of each land unit. All fertilizer is imported and transported over long distances, further compounding production costs.

- Financial institutions are reluctant to support maize production, particularly on SNL. Part of the reason has to do with the insecure land tenure system, which precludes ownership of land on SNL.

## 2.6 Overview of food aid program in Swaziland

The Government of Swaziland uses food aid to bridge deficits during crises. Given the fact that the country has never been able to produce enough food to feed its own people, much of the food in the country is normally imported from neighbouring South Africa. In times of crises, particularly during droughts and erratic rains or hailstorms, the situation is often exacerbated beyond the capabilities of being covered through commercial imports. In such situations, the Government resorts to food aid to supplement commercial food imports to cover domestic food gaps. Government usually provides food aid, either from its own resources or through requests for assistance from the international community.

The supply of food aid to Swaziland has varied since the early 1990's in response to prevailing rainfall conditions in various parts of the country. High levels of food aid have been received by the country in drought years as people could not produce enough food to sustain their households. The Swaziland Government advocates for local procurement of commodities for food aid programmes by Government agencies, Non Governmental Organisations or United Nations Agencies.

Information gathered from the NMC showed that local procurement gradually improved between 2002/3 and 2005/6 as shown in Table 2. Agencies that have supported local suppliers include the National Disaster Management Agency (NDMA), National Emergency Response Council on HIV/AIDS (NERCHA) and the World Food Programme (WFP). Commodities that have been bought by these agencies include maize and maize meal. Maize grain was bought from the NMC, while maize meal was supplied by Universal Milling and Ngwane Mills. Procurement of food aid commodities from local suppliers is highly commended because it encourages farmers in high rainfall areas to continue producing commodities, such as maize.

**Table 2: Local procurement of maize grain and maize meal for food aid, Swaziland (2002/03 – 2005/06)**

| **Maize Grain** | | | |
|---|---|---|---|
| **Buyer** | **Year** | **Quantity (tons)** | **Price (E'000)** |
| Swaziland Government (NDMA) | 2002/03 | 718.85 | 1, 545 |
| | 2004/05 | 678.09 | 875 |
| | 2005/06 | 3821.91 | 4, 930 |
| | | 5157.95 | 6, 411 |
| | 2006/07 | 1771.18 | 2, 489 |
| NERCHA | 2003/04 | 1891.55 | 2, 270 |
| | 2004/05 | 92.00 | 110 |
| | 2005/06 | 1500.85 | 1, 467 |
| | 2006/07 | 924.75 | 1, 547 |
| **Maize Meal** | | | |
| **Source** | **Year** | **Quantity (tons)** | **Price (E'000)** |
| WFP | 2004/05 | 1767.00 | 2, 209 |
| | 2005/06 | 1847.00 | 2, 124 |
| Universal Milling | 2004/05 | 700.00 | 1, 181 |
| Ngwane Mills | 2005/06 | 1079.00 | 1, 544 |

**Sources:** National Maize Corporation (2006) and World Food Programme (2006)
**Key:** E – Emalangeni (local currency; E1 = R1)

The World Food Programme (WFP) and the National Disaster Management Agency (NDMA) primarily manage the overall food aid programme in Swaziland. Food aid in Swaziland is clustered under disaster relief. By law relief programmes are governed by the newly formulated Disaster Management Act of 2006, which is under the mandate of the Deputy Prime Minister's Office. 'Disaster' is defined under the Act as a serious disruption of the functioning of society, causing widespread human, material or environmental losses, which exceed the ability of the affected society to cope using its own resources (Disaster Management Act, 2006: Part I, S4).

Swaziland does not have a food aid policy, instead there is a relatively new food security policy that was approved by Cabinet in December 2006. The food security policy was developed by the Ministry of Agriculture & Cooperatives, in consultation with stakeholders. The issue of food aid features in the food security policy, focusing on improvement of the effectiveness of food aid management. The policy notes that transparency, accountability and equity at all stages must be paramount, from the assessment of needs to targeting of beneficiaries and the distribution process itself.

The WFP and the NDMA collaborate closely in various planning aspects, but independently implement their respective assistance programmes. Field implementation of food assistance activities is generally done through various Non-Governmental Organizations (NGOs) and other implementing partners. The mode of implementation and type of activities supported can differ significantly depending on the implementing agency, type of beneficiaries and area of operation. The agencies involved in the general relief programme are as shown in Table 3.

**Table 3: Agencies involved in the general relief programme in Swaziland, 2006**

| **Agency** | **No. of Households** |
|---|---|
| Africa Cooperative Action Trust | 15, 685 |
| Caritas | 38, 283 |
| Lutheran Development Society | 50, 136 |
| Red Cross | 44, 216 |
| Save the Children | 43, 095 |
| Swaziland Farmer Development Foundation | 45, 153 |
| World Vision | 73, 830 |
| **Total** | **310,398** |

**Source.** National Disaster Management Agency, 2006

The Vulnerability Assessment Committee normally takes the lead in seasonal assessments based on the analysis of major food security indicators, such as climate and weather, agricultural activities and crop production statistics, livestock conditions, and other household income sources. The assessment approach is mainly qualitative and based on information provided by zones, supplemented by rapid rural assessment techniques. The vulnerability assessment is used to estimate the size of the vulnerable population and resources needed to avoid a crisis situation. Within each region, the actual identification of households is done at chiefdom level where the inner council, in collaboration with the responsible donor agency, identifies affected households. The inner council is a small committee at chiefdom level that works closely with the chief on matters related to development issues for that particular chiefdom.

A household that has been identified for benefiting under the food aid programme will receive assistance on a per person basis. The ration size per person per month in kilograms is shown in Table 4.

**Table 4: Food aid ration size per person per month in Swaziland, 2006**

| Food type | Amount per person |
|---|---|
| Cereal | 12 kg |
| Pulse | 1.8 kg |
| Corn Soya Blend | 1.5 kg |
| Vegetable oil | 0.75 kg |

**Source.** National Disaster Management Agency, 2006

The total number of beneficiaries in the 2006 season was composed mainly of households located in the Lowveld, dry Middleveld and part of the Lubombo Plateau. Before the worst drought of 1992, these areas were well known for being leaders in cotton production. However, the onset of drought, coupled with a decline in the producer price of cotton, saw a majority of farmers pulling out of production. Presently, these areas are producing neither cotton nor food crops and heavily rely on food handouts for survival.

The World Food Programme (WFP) undertook a major food aid programme in Swaziland in response to the 2001/02 drought that resulted in widespread crop failure that affected most of southern Africa. The situation was made worse by the HIV/AIDS pandemic, chronic poverty and economic decline that threatened the lives and livelihoods of about 250,000 people (almost a quarter of the population) in the country. Since January 2005, the WFP has also been implementing a three-year Protracted Relief and Recovery Operation (PRRO) aimed at improving food security, enhancing livelihoods and re-building productive capacity of the vulnerable, including HIV/AIDS infected and affected people. The PRRO is planned to reach an average of 250,000 beneficiaries per annum over the three-year period through the distribution of 49,141 tons of food commodities. A total of seven activities are currently being implemented by the WFP PRRO. The targeting criteria and distribution according to agro-ecological zones is presented in Table 5.

**Table 5: WFP food aid activities in Swaziland**

| Activity | Targeting criteria | Distribution zones |
|---|---|---|
| Support to anti retroviral treatment (ART) patients | The beneficiaries are food insecure and with no means or evidence of support or showing symptoms of malnutrition and are patients on anti retroviral treatment (ART), direct observatory treatment shorts (DOTS) and prevention from mother to child plus (PMTCT+). | The whole country (6 hospitals and 5 health centres) |
| Support to households affected by AIDS | The beneficiaries are households that are food insecure and with their breadwinners on anti retroviral treatment (ART). | Lowveld, Dry Middleveld and Lubombo Plateau |
| Support to orphan and vulnerable children (OVCs) in neighbourhood care points (NCPs) | Vulnerable children that attend neighbourhood care points (NCPs) and are food insecure. Vulnerability of the children can be caused by:<br>• Guardian or parents incapable of caring for the children<br>• Lives in a poor sibling headed household<br>• Lacks access to healthcare, education, food, clothing, psychological care and has no shelter<br>• Exposed to sexual or physical abuse | The whole country including urban areas (503 neighbourhood care points). |
| School feeding programme | School targeted by WFP has the following characteristics:<br>• Located in a food insecure area<br>• Is supported by Government of Swaziland in terms of staffing and other pertinent inputs<br>• Has water and sanitary facilities | Lowveld, Dry Middleveld and Lubombo Plateau (174 schools) |
| Clinic Feeding | The beneficiaries are food insecure and with no means or evidence of support or showing symptoms of malnutrition, on Family planning (FP) and Mother and Child Health Nutrition (MCHN) in health facilities | The whole country but only in rural clinics (56 rural clinics) |
| Food-for-work | Vulnerable households:<br>• Inability to access food<br>• No family members with employment<br>• Little or no source of income in the household (vegetables, remittance income)<br>• Few or no livestock assets<br>• Number of children in the household and number of children attending school<br>• High risk of selling/depleting assets to buy food | Lowveld, Dry Middleveld and Lubombo Plateau |
| General food distribution | Vulnerable households:<br>• Inability to access food<br>• No family members with employment<br>• Little or no source of income in the household (vegetables, remittance income)<br>• Few or no livestock assets<br>• Number of children in the household and number of children attending school<br>• High risk of selling/depleting assets to buy food | Lowveld, Dry Middleveld and Lubombo Plateau |

**Source:** World Food Programme (2006)

WFP's intervention in the country's affected areas is very commendable mainly because they have contributed to the household food security of the most vulnerable groups at three levels.  These are: food availability in physical stocks, access to food through entitlements, and utilisation through the provision of nutritious foods in adequate amounts.

# CHAPTER 3

# REVIEW OF RELATED LITERATURE

## 3.1 Introduction

This chapter provides an insight into global debates on the benefits and disadvantages of food aid in developing and least developed countries. The chapter begins by defining food aid and then discusses the importance of food aid to beneficiaries. The discussion on the importance of food aid is followed by a review of commodities typically involved in food aid programs, donors, recipient countries, mode of distribution and sources of procurement. The food aid disincentive effect is then reviewed, followed by a discussion on the relationship between commercial imports and food aid.

## 3.2 Defining food aid

Various authors define food aid differently. ODI (2000:1) defines food aid as, "a commodity that is used either to support food assistance actions or to fund development, by providing balance-of-payments support in substituting for commercial imports, budgetary support through the counterpart funds generated from sales revenue." Von Braun (2003), as cited by Lowder and Raney (2005:1), defines food aid as, "all food-supported interventions aimed at improving the food security of poor people in the short and long term, whether funded via international, national or public sources." Food aid can also be defined as, "the international sourcing of concessional resources in the form of, or for the provision of food" (Barrett and Maxwell, 2005:2). On another note, Barrett (2006b:1) considers food aid as, "an instrument for addressing acute and chronic food insecurity in low income communities."

In a food aid meeting held in Berlin, Germany in 2003, defining food aid at first seemed easy but food aid experts struggled to agree on a common definition (Lowder and Raney, 2005). Eventually, a definition was agreed upon, that food aid includes all domestic actions and domestically funded distribution of food as well as non-food resources used for food security purposes (Lowder and Rany, 2006). As such, the Berlin definition is similar to what is generally considered as Food Based Interventions (FBIs). Food Based Interventions are food distributions, market interventions and/or financial transfers that are funded nationally or internationally with the aim of improving food security (Clay, 2005). The components of the 'Berlin definition' were also echoed by Maunder (2006) who in his definition of food aid mentioned that food aid is not to be equated solely with in-kind transfers of food provided to victims of disasters.

### 3.3 Importance of food aid

Although food aid programmes were not originally focused on humanitarian objectives, the intent of most food aid today is to relieve unnecessary human suffering (Barrett, 2006a). In a world in which nearly half the population survives on US $2 per day or less, more than 800 million people go to sleep hungry, and given that a child dies every five seconds due to hunger-related causes, the need to respond to the need for food is ever-present and widespread (Barrett, 2006b).

The implications of food aid for addressing hunger are perhaps more obvious when the number of beneficiaries receiving food aid in a given year is considered (WFP, 2004). The World Food Programme (WFP) distributes about 40% of global humanitarian food aid each year. If the food aid indeed reaches the hungry, then humanitarian food aid is potentially important to the short run access to food for many who suffer from hunger (Lowder and Raney, 2006).

In sub-Saharan Africa, observations are that per capita food production has been declining over the years (1970-2002), and food aid has played a major role in reducing the food gap (Gebreselassie, 2006; Verheye, 2001). This is clearly reflected in Figure 2 that shows the trends of per capita food production and food aid flows in sub-Saharan Africa between 1970 and 2002.

The reasons behind the decline in per capita food production include frequent droughts, low productivity, limited access by farming households to improved technology, declining soil fertility and Government macro-economic policies that are not fully supportive of the agricultural sector (FAO/WFP, 2005). For instance, Southern African Development Community (2005) reports that almost all SADC member states have still not achieved the Dar-es-Salaam declaration target of allocating at least 10% of their national budgets to the agricultural sector.

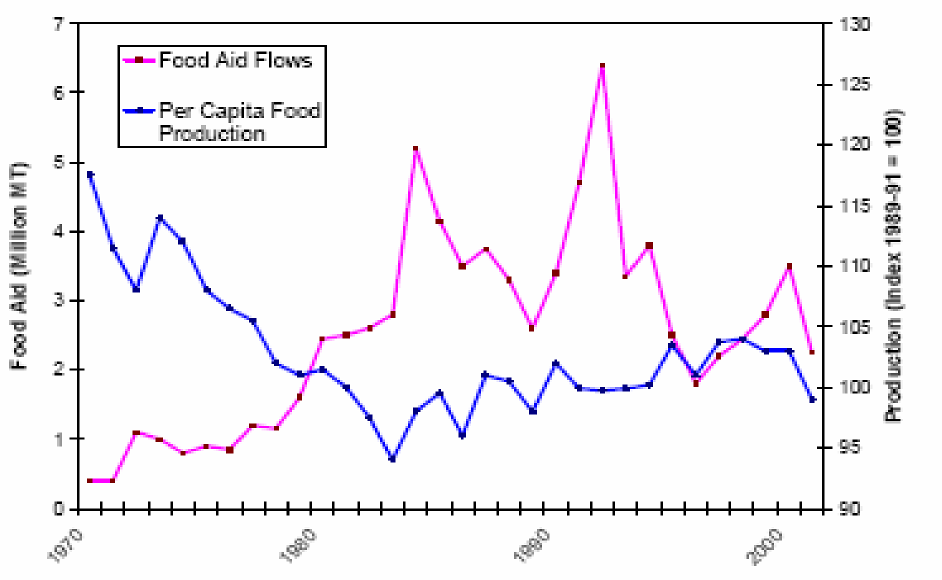



**Figure 2: Per capita food production and food aid flows in sub-Saharan Africa, 1970 – 2002 (FAO, 2003)**

In (SADC), cereal production has been declining, whereas commercial imports and food aid, that were both declining in the mid 1990's, after reaching a peak in the drought of 1994, have been steadily increasing over the past four years.

In 2005, at least 15 million people benefited from food aid programmes in SADC as a result of the drought that continues to affect the region (Integrated Regional Information Network, 2005). Almost half of the population in Lesotho and a quarter of the population in Swaziland were reported to be in risk of hunger in 2005. In Malawi, some 1.7 million people needed assistance in 2005 and in Zimbabwe almost 2.3 million needed food aid in the same year (IRIN, 2005).

External assistance programmes in the form of food aid are therefore believed to help relieve effects of food shortages in affected countries (Bezuneh *et al*, 1998; Shaw and Clay, 1993). If targeted in ways that do not displace domestic production, food aid can play a significant role in addressing hunger (Cohen, 2000) as food aid helps to meet the needs of households that would not normally afford food either through markets or production (Bezuneh et al, 1998; Webb, 2003).

### 3.4 Food aid commodities

The majority of food aid consists mainly of cereals that include wheat, maize and rice, and other non-cereal commodities. Wheat is the most popular form of food aid, followed by maize and rice. Food aid data provided by the World Food Programme (WFP, 2005) classify food aid commodities into cereals and non cereals. The cereals are as mentioned above (wheat, maize and rice), whereas non-cereal products include skimmed milk powder, vegetable oil, butter, oil and other dairy products. Cereal food aid, as can be seen from Figure 3, represents the major food aid commodities in any given year between 1970 – 2003.

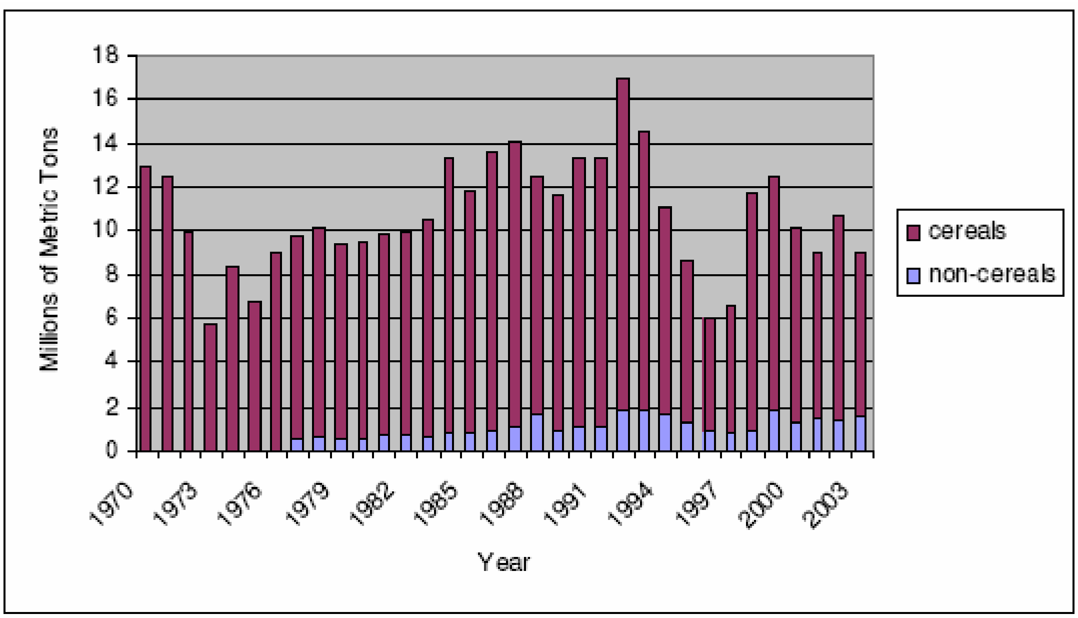
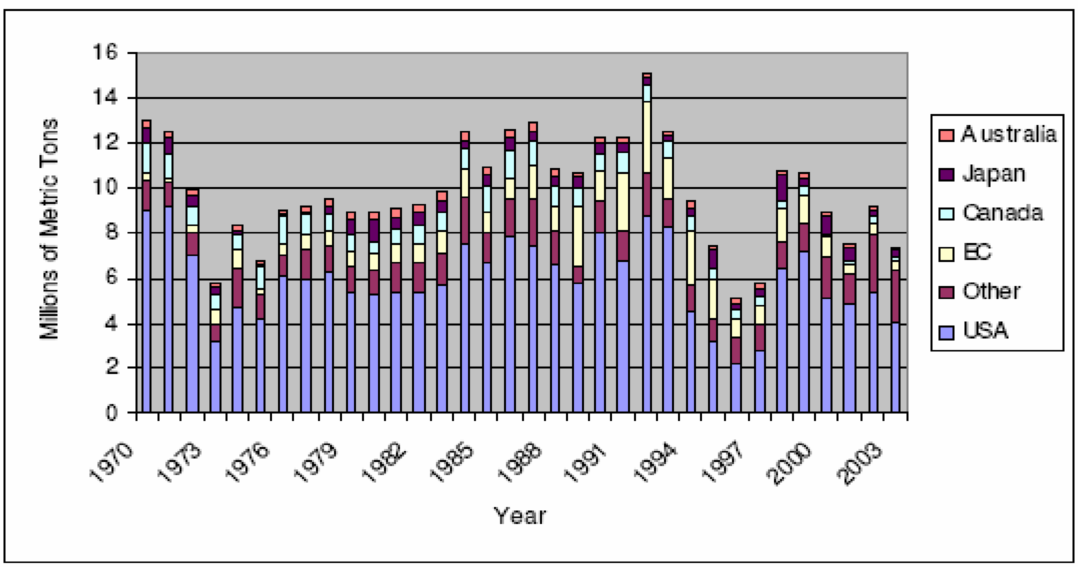



**Figure 3: Global food aid by commodity type, 1970 – 2003 (International Food Aid Information System, 2005).**

### 3.5 Donors

Provision of food aid has been dominated by a few donors over the years. This section identifies the donors who have dominated global food aid programmes since 1970. The International Food Aid Information System (INTERFAIS) dataset provides a list of 217 donors that include the United States of America (USA), the European Commission (EC), 79 individual countries, the World Food Programme (WFP), and Non Governmental Organisations (NGO's). The leading food aid donor, according to WFP (2005), is the USA. Since 1970 USA has contributed, on average, six million tons of cereal food aid annually and has been the source of about 60% of total cereal food aid (WFP, 2005). Other major donors, in decreasing order of importance are: the European Commission, Japan, Australia and Canada (Barrett and Maxwell, 2005). China and India have also emerged as donors of food aid in recent years (Webb, 2003). Figure 4 presents the levels of cereal food aid shipments by donors between 1970 and 2003.



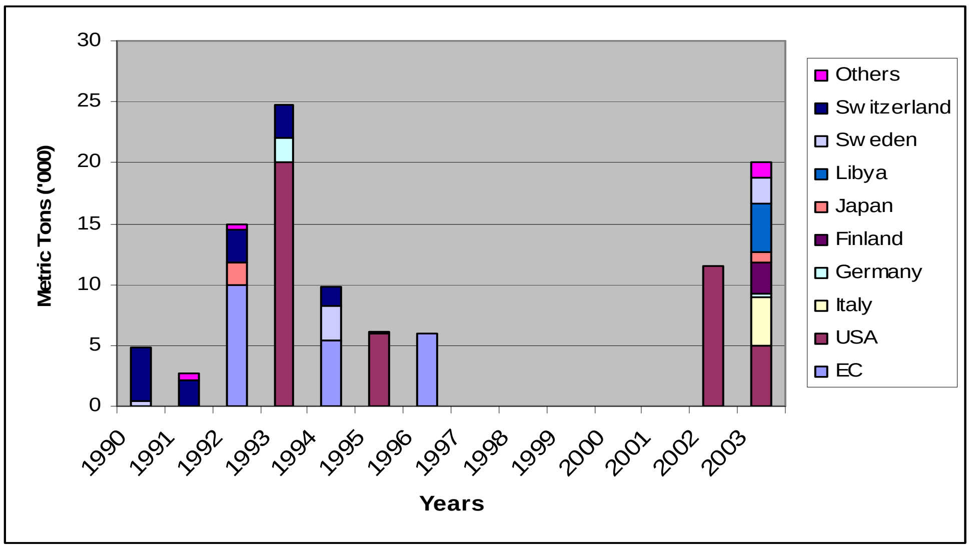

Where:

EC = European Commission

USA = United States of America

**Figure 4: Levels of global cereal food aid shipments by donor, 1970 – 2003 (INTERFAIS, 2005).**

Cereal food aid supplied to Swaziland between the period of 1990 – 2003 has been dominated by the USA that provides 42% of total cereal food aid supplied to Swaziland. As shown in Figure 5, the USA is followed by the European Commission (EC) with 21% of cereal food aid and Switzerland that contributed 13% of total cereal food aid. The rest of the donor countries include Sweden, Libya, Italy, Japan, Finland and Germany (WFP, 2005).




Where:

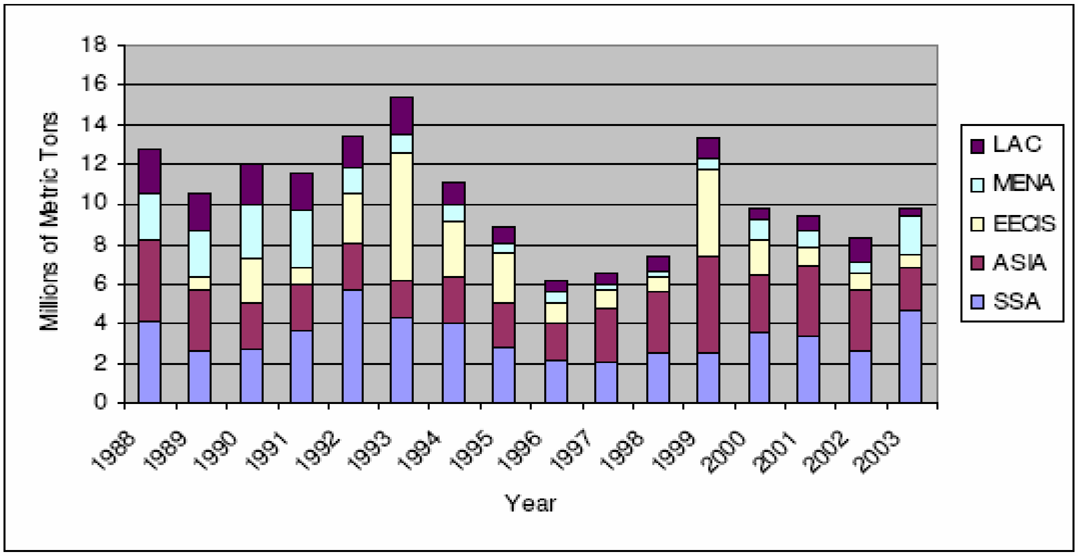
EC = European Commission

USA = United States of America

**Figure 5: Levels of cereal food aid shipments to Swaziland by donor, 1990 – 2003 (INTERFAIS, 2005).**

### 3.6 Recipients of food aid

According to WFP (2005), the two regions receiving the most cereal food aid internationally are sub-Saharan Africa and Asia. In the 1970's, most food aid was channelled to Asia, but by the 1980's, especially after the huge gains in food security due to the results of Green Revolution, Asia became less of a focus for food aid. In the 1990's and 2000, food aid to Asia declined and sub-Saharan Africa began to receive larger quantities. Recipients of the ten largest amounts between 1988 - 2003 in decreasing order, were: Ethiopia, Bangladesh, Russia, North Korea, Egypt, Mozambique, India, Sudan, Indonesia and Peru. The majority of recipients (48 countries) are located in sub-Saharan Africa, seven countries in Asia, 31 countries in Latin America, 17 countries in Eastern Europe, 15 countries in both North America and the Middle East (WFP, 2005). Figure 6 presents a graphical representation of cereal food aid received per region between 1988 – 2003.




Where:

LAC = Latin American countries

MENA = Middle East and North America

EECIS = Eastern Europe and Commonwealth Independent States

SSA = Sub-Saharan Africa

**Figure 6: Global cereal food aid by recipient region, 1988 – 2003 (INTERFAIS, 2005)**

The distribution of food aid from donor countries to recipient countries takes various forms but the forms are typically classified into three major categories as elaborated in the next section.

### 3.7 Mode of distribution

There are three major modes of food aid distribution, namely: programme food aid, project food aid and emergency food aid (WFP, 2005).

- Programme food aid is either donated or sold at a concessional price to the Government of a recipient country which then sells the food on the national market (WFP, 2005).
- Project food aid is distributed for free (or in exchange for work) to participants in programmes typically run by Non-Governmental Organisations (NGOs) that are intended to promote agriculture and/or economic development. Examples include food-for-work, school feeding and mother-to-child nutrition schemes (WFP, 2005).
- Emergency food aid is distributed to the food insecure in times of crises such as war, famine and/or drought (WFP, 2005). Emergency food aid is sometimes referred to as humanitarian or relief food aid.

Figure 7 shows global cereal food aid by mode of distribution (programme, project or emergency) from 1978 – 2003. Figure 7 shows that programme food aid used to dominate global food aid flows. However, reports from the WFP show that this has since declined. Decreases in the allocation of programme food aid are largely the result of increased emphasis on humanitarian aid and of less abundant stocks of cereals in donor countries as trade liberalisation takes the centre stage. Recent increases in emergency aid and relative stagnation of project food aid are likely due to donor fatigue as a result of lack of evidence that project food aid fosters development, concerns over distortion resulting from development food aid, and increased incidence of or awareness of emergencies (Russo *et al*, 2005).

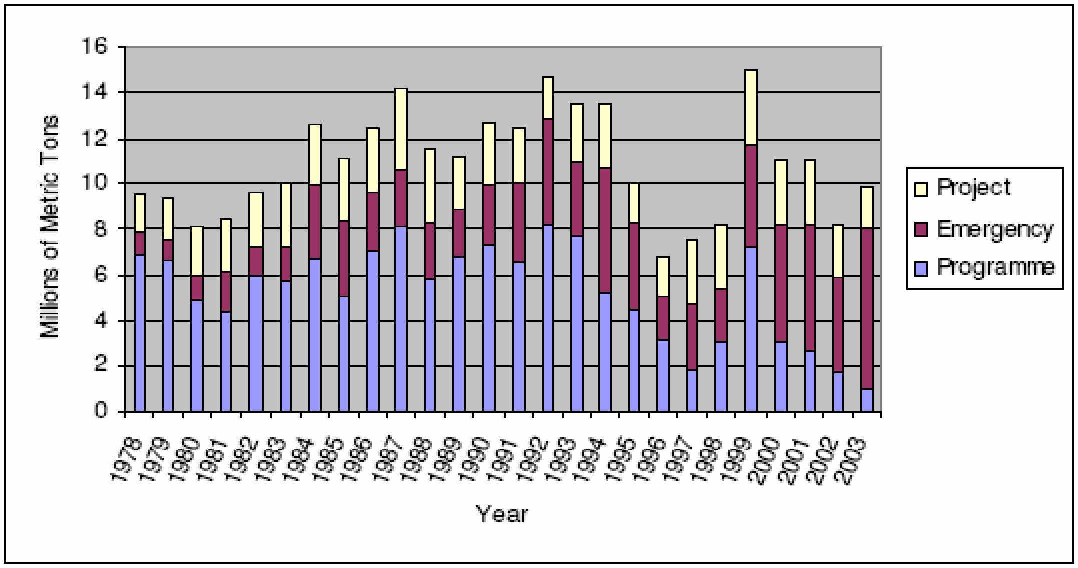



**Figure 7: Global cereal food aid by distribution mode, 1978 – 2003 (INTERFAIS, 2005).**

In the case of Swaziland, emergency food aid has been the dominant food aid programme between 1990 and 2003 and accounted for 71% of total food aid received by the country. Figure 8 shows that emergency food aid was followed by project food aid that accounted for 26%, whereas programme food aid accounted for only 3% of total food aid support to Swaziland. Supply of emergency food aid began to increase in 1991/1992 in response to the drought that hit the entire SADC region. In 1997, 2000 and 2001, no food aid support was recorded by INTERFAIS for Swaziland.

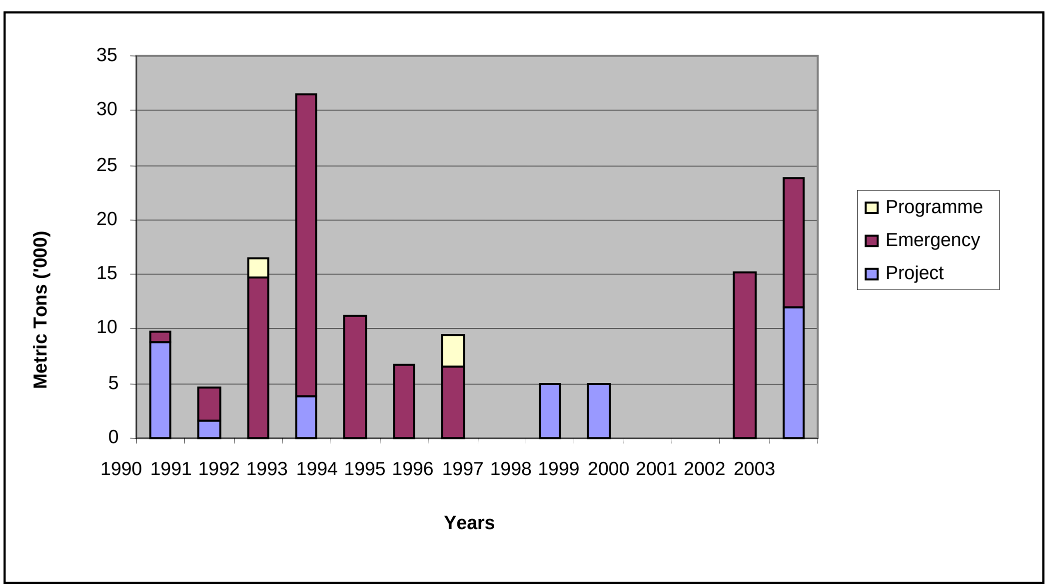


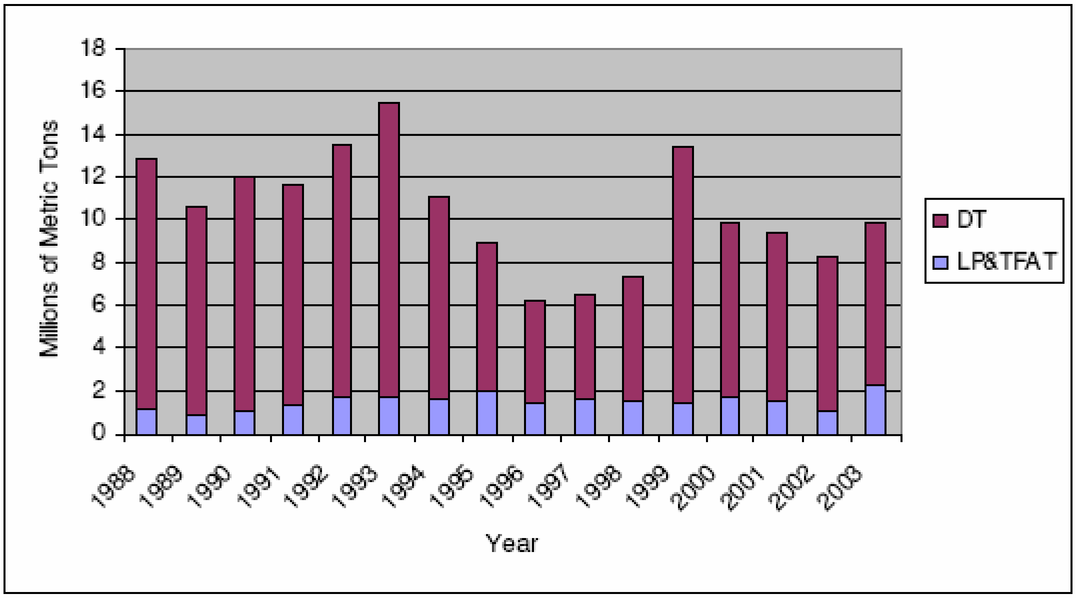

**Figure 8: Cereal food aid by distribution mode supplied to Swaziland, 1990 – 2003 (INTERFAIS, 2005)**

### 3.8 Local and regional procurement of food aid

Where in-kind food aid distribution has been assessed by donor agencies to be an appropriate option for intervention, the source of procurement is a critical factor in determining the market and production disincentives of food aid (Maunder, 2006). When sufficient food is available in-country, either through domestic production or commercial imports, local procurement of food aid is preferred by recipient countries to reduce the risk of market distortions and support local trade systems (Maunder *et al*, 2006). However, where adequate food is not available on local markets, the next best option to consider is the use of regional procurement (otherwise known as triangular food aid transaction). Like local purchase, regional procurement has ancillary benefits of improving the timeliness of delivery, providing appropriate food rather than conflicting with local consumption patterns and supporting establishing national and local marketing structures and producers (Barrett and Maxwell, 2005).

Until the mid 1990's, local and regional purchases represented about ten percent of global cereal food aid, but they have grown to more substantial amounts in recent years, fluctuating between 12-20% of total cereal food aid (WFP, 2005). The USA and Canada provide the majority of their food aid in kind, whereas most local and regional purchases are undertaken by other donors, including Japan, Australia, the European Commission and World Food Programme (WFP). In the year 2000, WFP purchased more than 25% of the food used in its operations through local and regional purchases (Barrett and Maxwell, 2005).

Figure 9 presents a comparison between figures of food aid supplied either through direct transfers from donors or procured locally or regionally between 1988 and 2003.




Where:

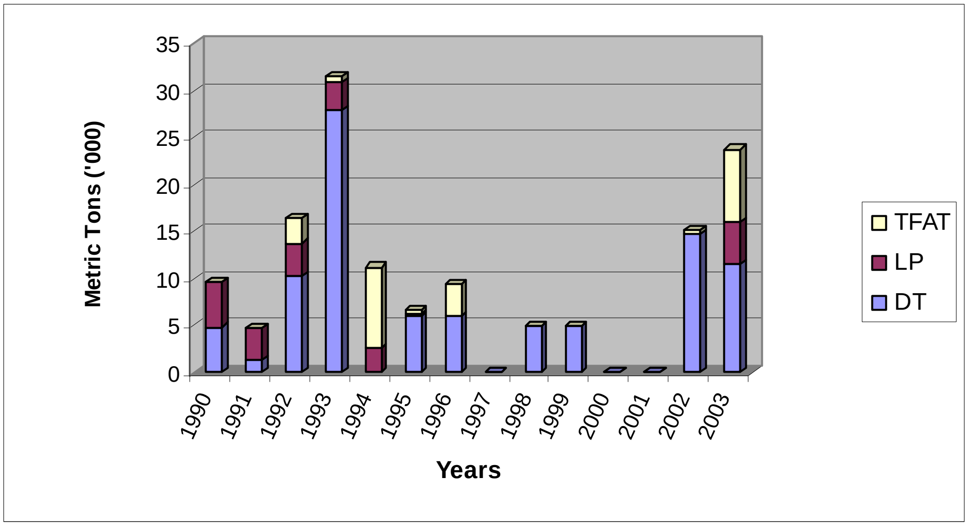
DT = Direct transfer

LP = Local purchase

TFAT = Triangular food aid transaction

**Figure 9: Global cereal food aid by mode of procurement, 1988 – 2003 (INTERFAIS, 2005).**

In the case of Swaziland, between 1990 and 2003, food aid was dominated by supplies through direct transfers from donors. Only in 1994 was food aid supplied for the first time through triangular purchases and local procurement. As reflected in Figure 10, between 1990 and 2003, direct transfers accounted for 67% of total food aid supplied to Swaziland, followed by triangular purchases with 17% and local procurement with 16%. The Government of Swaziland is making efforts to convince food aid suppliers to consider buying food aid items in domestic markets as this will contribute significantly towards local production and economic growth (GoS, 2005b).




Where:

DT = Direct transfer

LP = Local purchase

TFAT = Triangular food aid transaction

**Figure 10: Total food aid supplied to Swaziland by mode of procurement, 1990 – 2003 (INTERFAIS, 2005).**

### 3.9 Disincentive effects of food aid

The debate over food aid, according to Lowder (2004), dates back to 1959 from an article written by Cochrane (1959), claiming that agricultural supplies from the USA could be dispensed in the form of food aid to promote economic development in poor countries. Schultz (1960) published a rebuttal of Cochrane's argument in an article that warned that food-for-peace is likely to have an adverse impact on farmers in recipient countries (Lowder, 2004; Barrett, 1999). Schultz (1960) was so influential that even today, more than 40 years later, disincentives for food production in recipient countries remain at the heart of every food aid debate (Tapio-Bistrom, 2001; Lowder, 2004).

De Carvalho (1999) argues that besides the immediate welfare improvements brought by food aid to food deficient countries, particularly during emergencies, such interventions bring negative consequences in terms of sustainable development and food security improvement. Most food aid critics are concerned that food aid programmes could be counter-productive or even contribute to long-term food insecurity in recipient countries (Schneider, 2005).

Disincentive effects of food aid on domestic agricultural production may result from farm level responses to price reduction caused by increased food supplies (Clark, 2001) and dependency effects at the Government level that reduce incentives to emphasise agricultural development in central Government policy (Doroch and Subbarao, 2005). Households that are normally food insecure and benefit from food aid, are sometimes both producers and consumers and face low prices when they sell their produce at harvest time and high prices when they buy food later in the year (Gabreselassie, 2006).

With reference to the case of Malawi, it was discovered that food aid supplies in 2002/2003 season reduced demand for commercial maize, resulting in unintended excess stocks of commercial maize, which exerted a dampening effect on consumer prices during the year and producer prices for the next harvest (Jere, 2007).

Food aid can drive down local (national) food prices in at least three ways (Barrett, 2006). First, monetisation of food aid can flood the market, leading to an increased supply. Second, households receiving food aid may decrease demand for the commodity received or for locally produced substitutes. Third, recipients may sell food aid to purchase other necessities or complements and by so doing, they drive down prices of the food aid commodity and its substitutes, but also increase demand for the complements (Barrett, 2006a).

Donovan *et al* (2006) acknowledge the fact that food aid has disincentives to recipient countries. However, they feel that the negative effects of food aid can only be realised when certain conditions prevail. According to Donovan *et al* (2006), food aid can have strong negative effects, when:

- Food aid is distributed during harvest time;
- Very large quantities of food aid are released directly into countries with markets that operate with similar locally produced products;

- Poor commodity targeting is implemented, such that the food aid commodities given to households are likely to be exchanged in markets, particularly when that commodity has a local substitute such that the increased market supplies lower prices for the locally produced substitute;
- Corruption leads to food aid never reaching intended recipients but rather diverted onto the markets; and
- Uncertainty in food aid programming (and national Government planning) results in constantly changing estimates of food aid needs and Government policy responses, such that traders face high risks and become reluctant to engage in trade.

Inconsistency in terms of food aid management on the Government side can also occur. For example, Government can release grain provided under a food aid programme into the market at below market price. In such a situation, reduced trade volumes and profitability may serve to undermine private trade confidence in the market and reduce private investment that, in the extreme, can lead to disinvestment and business closure (Maunder, 2006).

Political disincentives also constitute a substantial dimension in the food aid debate (Dorosh and Subbarao, 2005). As food aid has focused increasingly on emergencies over the past decade, its use in areas of civil conflict has expanded. Barrett (2006) notes that, although food aid is universally intended to provide relief to food insecure people, it has, on occasions, been inadvertently used as an instrument for oppression and violence by political leaders. Food deliveries have been manipulated by political leaders so as to deny disfavoured populations access to food, secure the allegiance of other populations in political contests, and augment military food supplies (Maunder, 2006). This issue has become a real concern to the donor community (Barrett and Maxwell, 2005).

Food aid may also dissuade local Governments from taking initiatives and using national resources to tackle problems of food insecurity (Maunder *et al*, 2006). Food aid can also foster the continuation of ineffective policies such as highly inefficient food subsidy programmes underpinned by food aid shipment programmes that largely benefit the middle and upper classes (Barrett and Maxwell, 2005). However, attempts to use food aid-tied conditions to foster useful policy reforms in recipient countries have generally been a failure as no tangible results have been seen in targeted countries (Barrett, 2006a).

General observations, according to Barrett (2002), Tschirley and Howard (2003) and Schneider (2005), are that the balance of positive and negative effects of food aid on domestic agriculture depend critically on how the food aid was managed, delivered, and distributed within the recipient country and on the country's overall economic and agricultural sector policies.

### 3.10 Food aid and commercial imports

A few studies have examined the impact of food aid on commercial imports. Findings by Ruttan (1993) and Ball *et al* (1996) reflect that countries with low production levels are often considered needier and receive more targeted food aid. Lavy (1990) found evidence that low production causes increased food aid receipts. Production levels are not the only determinants of food aid allocation but commercial imports also play a role as they are correlated with the amount of food aid allocated by donors (Lowder, 2004).

Since targeted food aid is allocated largely on the basis of need, countries with a poor ability to import food are more likely to receive targeted food aid, hence commercial imports and food aid are negatively correlated (Barrett, 1998). Lowder (2004), in a study covering global food aid and import data between 1988 to 2001, concluded that programme food aid displaces commercial imports on a one on one basis. In another international study, Clay *et al* (2005) cited by Maunder (2006), found that one kilogram of food aid displaced 0.7 kg of commercial imports. Tiba (2002) states that between half and three-quarters of all food aid acted as a substitute for commercial imports, although it is not clear how this estimate is derived. Barrett (1999) also found a negative correlation between the United States of America's programme food aid and contemporaneous commercial imports. Maunder (2006) drew a conclusion from the above findings, stating that only when commercial imports are fully displaced will food aid compete with domestic production.

## 3.11 Quantitative methods of analysing the impact of food aid on agricultural production

The proponents and critics of food aid have strong and divergent opinions on the incidence and severity of the production and market impacts of food aid. However, these debates are often grounded on anecdotal, rather than based on a careful examination of empirical evidence.

It is not easy to arrive at a concise conclusion on whether food aid affects agricultural production, given the mixed evidence of past studies (Tapio-Bistrom, 2001; Lowder, 2004). Evaluating the degree of effectiveness of food aid is presently a divisive issue within the donor community, since many Governments prefer assessments based on food aid deliveries rather than on effectiveness of aid in recipient countries (Schneider, 2005).

Tapio-Bistrom (2001) used a reduced-form market equilibrium model to analyse the impact of food aid on food production in Tanzania. This was a national level study that involved the use of secondary data covering the years between 1971 – 1996 and included variables such as quantity of maize produced, official and unofficial maize prices, fertilizer costs, agricultural labour costs, rainfall data, transport costs, variance of open market price, variance of food aid, total food aid and total commercial maize imported. The impact of food aid was measured using the reduced-form market equilibrium model that consisted of quantity and price functions estimated simultaneously using the above variables through a Full Information Maximum Likelihood (FIML) method. Empirical findings did not indicate a statistically significant disincentive effect of food aid on maize production and maize producer price in Tanzania.

Lavy (1990) and Abdulai *et al* (2004) used a vector autoregression (VAR) analysis to study the impact of food aid on food production in 33 and 42 sub-Saharan countries, respectively. Swaziland was included in the 2004 study conducted by Abdulai *et al*. Lavy (1990) used secondary data (1970 - 1987) to estimate equations for food production and food aid. Results obtained from this study showed that food aid had a significant positive effect on food production. The positive net effect of food aid on food production suggested that any disincentive induced by the additional supply of food was offset by the positive effect of food aid on food production. Lavy (1990) attributes this to the benefits of relaxing liquidity constraints and increased fertilizer consumption which he says, outweighed price disincentives.

Abdulai *et al* (2004) used secondary data (1970 – 2000) to estimate a vector autoregression (VAR) model for 42 sub-Saharan countries who had benefited from food aid interventions. The estimation results showed that, on average, food aid exerts a positive impact on food production. The study discovered that the positive net effect of food aid on food production indicated that any disincentive effects due to depressed product prices induced by food aid shipments were more than offset by positive risk management and factor price effects. This is not to say that food aid is necessarily the best possible resource to use for rural development interventions, but that rural sub-Saharan Africa is so starved for resources that any reasonably well-managed aid programme can have net beneficial effects, despite the well known product market disincentive effects associated with food aid (Abdulai *et al*, 2004).

Lowder (2004) also used a vector autoregression (VAR) analysis that differentiated the analysis for programme and emergency food aid. The sample included all 145 global food recipients between 1988 and 2001. The study found that neither programme nor emergency food aid was significantly associated with changes in domestic agricultural production.

A Three-Stage Least Squares (3SLS) method of estimation was used by Demeke *et al* (2004) to study the effect of food aid dependency at the macro-economy level and the effects of food aid on agricultural production at household level in Ethiopia. The macro-economic effect of food aid was analysed using national time series data from 1980 – 2001. The system of equations specified in the model consisted of six equations (five stochastic equations and one identity equation describing the equilibrium between demand and supply for food aid). The equations used five endogenous variables (total quantity of local grain, per capita domestic demand for grain, per capita consumer's disposable income, commercial imports, and food grain producer price), and six exogenous variables (weather index, index for non-agricultural production, world price of food grain, food aid, retail price for food grain, and total foreign exchange flows). The equations were estimated in a linearised double-log form using 3SLS. The results of the study revealed that at the macro-economic level, food aid increased the total domestic supply of food grains. However, a sustained increase in food aid quantity was found to have dampening effects on domestic production of food grain. Therefore, the effects of food aid on the agricultural sector appeared to be significantly negative as it put downward pressure on food grain producer prices.

To evaluate the impact of food aid at household level, Demeke *et al* (2004) used data collected from a household survey of 1469 households in Ethiopia. A supply model was developed where the dependent variable was the quantity of food grain produced. The model was estimated in a linearised double-log form using independent variables such as food aid per capita, participation in an extension programme, quantity of fertilizer used, possession of draft animals and land holding size. Using the total sample size, the effect of the food aid on total food grain produced was not significant. However, after the sample was truncated, to include only households that received food aid, the re-estimated model showed a statistically significant negative influence of food aid on food production at household level. Concentrating only on food aid recipient households was justified by the fact that, if food aid had any significant effect at household level, that effect would be more evident in the households involved in the food aid programme than the non-recipient households.

A recent review by Abdulai (2005) on disincentives, distortions, displacement and dependency effects of food aid failed to find strong empirical evidence in support of the hypothesis that food aid significantly displaces domestically produced food on recipient country markets.

The next section identifies the appropriate analytical tool to apply in this study. This is done by discussing the advantages and disadvantages of the most widely used and preferred analytical tools for studying the effects of food aid on local maize production.

### 3.12 Identifying the appropriate analytical tools for analysing the effects of food aid on local maize production

Literature has shown that country-specific impact studies (Tapio-Bistrom, 2001; Demeke et al, 2004) are analysed through the use of a market equilibrium model, where the effects of exogenous variables such as food aid can be analysed through solving simultaneous equations of the quantity function and price function. There are several possible techniques that can be applied to solve simultaneous equations, including the Full Information Maximum Likelihood (FIML), Three-Stage Least Squares (3SLS), Two-Stage Least Squares (2SLS), Limited Information/Maximum Likelihood (LIML), Least-Squares-No Restriction (LSNR) and Ordinary Least Squares (OLS) methods (Kuotsoyiannis, 1992; Gujarati, 1995). Of the above tools, the FIML and 2SLS methods are the most widely used (Bollen, 1996).

The Two-Stage Least Squares (2SLS) method, which uses a single equation framework, is preferred when the data set is not that large as it is capable of successfully eliminating the degrees of freedom problem (Wonnacott and Wonnacott, 1979:295; Bollen, 1996: 120-121). It is also an efficient estimator for reduced form equations even in the presence of multicollinearity (Kuotsoyiannis, 1992:510). The 2SLS method may also be less sensitive to specification errors in the sense that those parts of the system that are correctly specified may not be affected appreciably by errors of specification in other parts (Klein, 1974 cited by Gujarati, 1995; Kuotsoyiannis, 1992:511).

The FIML method, on the other hand, is preferred mainly because it estimates all the identified structural equations together as a set, instead of estimating the structural parameters of each equation separately. The main disadvantage is that, if there is a specification error (a wrong functional form or exclusion of relevant variables) in one or more equations of the system, that error is transmitted to the rest of the system, hence the system method becomes very sensitive to specification errors (Gujarati, 1995).

### 3.13 Summary

This chapter has shown that food aid is a complex mode of assistance that has both advantages and disadvantages. The debate on food aid disincentives began more than 40 years ago and is still being researched in a number of countries at various levels. A number of analytical tools have been used to study the impact of food aid on agriculture. Country specific impact studies assume that the reduced-form market equilibrium approach, which when correctly formulated, is capable of analysing the impact of food aid on both the quantity of agricultural produce and agricultural producer price.

The objective of this study is to study empirically whether food aid does have a disincentive effect on maize production in Swaziland. Similar studies such as Tapio-Bistrom (2001) and Demeke *et al* (2004) have used the reduced-form market equilibrium model to study the impact of food aid on maize production in Tanzania and Ethiopia, respectively, and the models performed satisfactorily in terms of availing empirical evidence.

# CHAPTER 4

# METHODOLOGY

## 4.1 Introduction

This chapter presents the methodology used to analyse the impact of food aid on maize production and maize producer price in Swaziland. It begins by discussing the research design, which is followed by methods of data collection. The collected data are then discussed in the context of how they were used as variables in the analysis. The last section reviews the analysis used to answer the sub-problems given in Chapter 1.

## 4.2 Research design

The overall objective of the study was to provide empirical evidence on whether food aid has a disincentive effect on maize production in Swaziland. The methodology adopted for this study is similar to that of Tapio-Bistrom (2001) that was applied to investigate the impact of food aid on Tanzania's maize industry. An econometric model was used to conduct an empirical measurement and testing of the research hypothesis.

Tapio-Bistrom's method was modified because of differences between the maize industries in Swaziland and Tanzania. Tapio-Bistrom (2001) separated the maize market into two (formal and open markets) in order to identify which market reliably represented the maize industry in Tanzania. The significant market was then used to formulate the reduced form market equilibrium model. For this particular study, separating the maize markets was not feasible because there are no available data on quantities of maize traded in the open market, except for maize prices, which are regularly collected by the National Early Warning Unit (NEWU). If food aid has an impact on maize production, the expectation is that it would have an impact on the entire industry, irrespective of whether a farmer is producing maize to be sold in the official market or open market. It is against this background that this study resorted to the use of a single maize production equation, which was tested for significance before formulating the reduced form market equilibrium model.

Tapio-Bistrom (2001) also included a variable on the minimum wage rate as a proxy for labour cost in maize production. In the Swaziland situation, it is on record (GoS, 2000) that more than 90% of the maize produced in Swaziland comes from smallholder farmers located on Swazi Nation Land (SNL). These are farmers who produce maize on an average land size of 1.7 ha using family labour. The variable of labour cost was, therefore, not included in this study.

## 4.3 Methods of data collection

The analysis relied on secondary national data from 1985 to 2006. Data were sourced from the Ministry of Agriculture and Cooperatives (National Early Warning Unit), Ministry of Natural Resources and Energy, National Maize Corporation, Central Statistics Office, Swaziland Meteorological Service, World Food Programme (INTERFAIS), Food and Agriculture Organisation (FAO) and local agricultural retail outlets that supply farm inputs.

Table 6 presents types of data collected for analysis and their respective sources. The year 1985 was used as the cut-off year simply because available records from the various data sources did not have reliable data in the years before 1985. For some variables data were available dating as far back as the early 1970's. However, that alone could not suffice since the analysis required the data set to have complete observations on all variables in the model for a specified time frame.

**Table 6: Data sources for variables used in analysing the impact of food aid on maize production in Swaziland**

| Data | Unit | Source |
|---|---|---|
| Quantity of cereal food aid (FA) | Metric tons | World Food Programme (INTERFAIS) and Food and Agriculture Organisation (FAO) |
| Commercial maize imports (I) | Metric tons | National Maize Corporation |
| Local maize production (Q) | Metric tons | Central Statistics Office and Ministry of Agriculture and Cooperatives (National Early Warning Unit), Swaziland |
| Official maize producer prices ( $\overline{p}$ ) | Emalangeni per ton | Ministry of Agriculture and Cooperatives (National Early Warning Unit), Swaziland |
| Open market maize producer prices ( $\tilde{p}$ ) | Emalangeni per ton | Ministry of Agriculture and Cooperatives (National Early Warning Unit), Swaziland |
| Fertilizer prices (r) | Emalangeni per ton | Farm Chemicals, Swaziland |
| Fuel prices (c) | Emalangeni per litre | Ministry of Natural Resources and Energy, Swaziland |
| Rainfall (D) | Millimetres | Swaziland Meteorological Service |
| Total area planted to maize (LM) | Hectares | Central Statistics Office, Swaziland |

A brief discussion on the nature of each variable considered is presented below:

- Local maize production refered to the total quantity of maize produced by local farmers, both commercial and smallholder farmers.

- Total cereal food aid refered to food aid quantities received by Swaziland and includes all cereal items such as maize, rice, and wheat. It was very difficult to collate the data on food aid quantities from local sources as record keeping by local agents is inconsistent and unreliable. The study, therefore, resorted to using data provided by the International Food Aid Information System (INTERFAIS), under World Food Program (WFP), that monitors food aid deliveries worldwide.

- Total commercial cereal imports included all cereals expressed in maize equivalents, imported through the National Agricultural Marketing Board.

- Official maize producer price was the gazetted floor price set by Government, through the Maize Marketing Committee, at the beginning of every maize marketing season. Many factors are considered when setting the price, but ultimately the purpose is to assist the farmer realise a positive margin. The gazetted floor price allows farmers to recover production costs and still generate profit. The official maize price is primarily used by the National Maize Corporation (NMC), which is the sole importer of maize and buyer of last resort in the country. Farmers are at liberty to sell to any buyer at any price. The official maize producer prices were adjusted using the national Consumer Price Index (1996 = 100). This allowed for effective computation and comparison of official maize prices over the years under review.

- The open market maize producer price refers to the price at which maize was sold in any market apart from the NMC official (or regulated) market. The prices in the open market vary from area to area and from time to time. In areas where maize is a scarce commodity, such as in the Lowveld and Lubombo, the prices are normally higher than in the Highveld where maize is a favourable crop to produce. This study used average annual prices for analysis. The prices were adjusted using the national Consumer Price Index (1996 = 100). This allowed for effective computation and comparison of open maize market prices over the years under review.

- Average fertiliser price refered to the weighted average costs of common fertilisers used for maize production in the different agro-ecological zones. The most commonly used fertilizers in maize production in Swaziland are NPK and LAN and the weighted price was calculated on the basis of 70:30 in favour of NPK, which is most used amongst the two. Fertiliser constitute the greater proportion of costs incurred in maize production (FANRPAN, 2003). The study used retail fertiliser prices adjusted using the national Consumer Price Index (1996 = 100). This allowed for effective computation and comparsison of fertiliser prices over the years under review.

- Average fuel costs were used as a proxy for transport costs. The assumption was that an increase in fuel costs will eventually lead to an increase in transport and land preparation costs. It was difficult to identify a factor that could be used to give a true and reliable reflection of transport costs incurred by maize producers in the different locations of the country. The fuel prices were adjusted using the national Consumer Price Index (1996 = 100). This allowed for effective computation and comparison of fuel prices over the years under review.

- Since most of the maize in Swaziland, particularly on Swazi Nation Land, is rainfed, it was deemed necessary to incorporate the impact of annual rainfall on the supply of maize. In rainfed agricultural production, drought or abnormally low precipitation usually explains variations and deficit years. Therefore, a weather dummy variable, constructed using rainfall statistics, was incorporated in the model. Yearly rainfall that was 10% below the long-term average rainfall was assumed to be a drought year whereas yearly rainfall above that was assumed to be a normal year (Tapio-Bistrom, 2001).

- Total area planted to maize refered to land under maize production in a particular season. It was expected that as the area under maize production increases, the total harvest of maize would also increase, assuming other factors of production remain constant.

### 4.4 Data treatment and analysis

#### 4.4.1 Developing a maize production model

First, the study developed a production model to reliably reflect the current institutional maize market in Swaziland. This is a supply function formulated on local farmers' behaviour in the present maize marketing system. Maize farmers in Swaziland sell their produce either to the National Maize Corporation (using the gazetted price) or on the open market (using the open market maize price). The production (supply) function was fitted using the Ordinary Least Squares (OLS) method to ascertain its significance prior to being used in formulating the reduced form market equilibrium model.

The quantity of maize produced for the official market (Q) was expressed using the open-maize market price ( $\tilde{p}$ ) lagged by one year, average fertilizer price (r), cost of fuel (c), rainfall (D) and land area under maize production (LM). In functional form the quantity of maize produced for the official market was represented as follows:

$$\log Q_t = \alpha_0 + \alpha_1 \log \tilde{p}_{t-1} + \alpha_2 \log c_t + \alpha_3 \log r_t + \alpha_4 D_t + \alpha_5 \log LM_t + \varepsilon_t \quad \text{……….…….(4.1)}$$

Where:

| | | |
|---|---|---|
| Q | = | Quantity of maize produced |
| $\tilde{p}_{t-1}$ | = | Open market maize producer price, lagged by one year |
| c | = | Transport cost (fuel price) |
| r | = | Average fertilizer cost |
| D | = | Rainfall - annual amount of precipitation. |
| | | 1 = normal year |
| | | 0 = drought year |
| LM | = | Land area planted to maize (ha) |
| $\varepsilon_t$ | = | Error term |

The production model used the open market price as opposed to the official market price because it is generally higher by 25 – 30% than the NMC official buying price (Oxford, 1998). Therefore, its inclusion accounted for the difference between the two prices. The maize producer price was lagged by one year since at the time of planting; a farmer would only know the previous year's maize producer price. Other variables such as transport cost, fertilizer price and rainfall were not lagged as they represent levels of occurrence in the same season as the quantity of maize produced. For instance, if farmers plough their fields in October/November 2006 the decision would be based on the amount of rainfall received during October/November 2006 and not on amount of rainfall received in October/November 2005. The same applies to prices of fertilizer and fuel. Prices that would be considered are prices for October/November 2006 instead of prices for October/November 2005.

The model was fitted using the Ordinary Least Squares (OLS) method and results are presented in Chapter 5.

### 4.4.2 Reduced-form market equilibrium model – at national level

Conventional economic theory states that aggregate demand and supply determine the market price (Cramer *et al.*, 1997). Therefore, both demand and supply specifications were used to analyse the effects of food aid on the quantity of maize produced and the maize producer price. The variable used for studying the impact of food aid was total quantity of cereal food aid received. The food aid variable was lagged by one year to express its impact on the production decisions of the following year. Lagging by one year was necessitated by the scarcity of data that did not permit the model to be lagged by more than one year.

The quantity and price functions were then solved simultaneously using a 2-stage least squares (2SLS) method (Gujarati, 1995: 687-689). As the name indicates, the method involves two successive applications of Ordinary Least Squares (OLS).

The study assumed that the dummy variables, proxy variables and averages for measuring impact of rainfall, fuel costs and fertilizer costs, respectively, were accurate in analysing variations caused by rainfall, transport costs and fertilizer costs in the model. It is also assumed that the maize industry in Swaziland is fully compatible with the neoclassical farm production theory and the concept of market equilibrium which formed the basis for this study.

In stage one, the two functions are expressed, where the quantity variable is a function of price and price is also a function of quantity.

$$\log Q_t = \alpha_0 + \alpha_1 \log \tilde{p}_{t-1} + \alpha_6 \log c_t + \alpha_2 \log r_t + \alpha_3 \log FA_{t-1} + \alpha_4 D_t + \alpha_5 \log LM_t + \varepsilon_t \quad \text{.......... (4.2)}$$

$$\log \tilde{p}_t = \beta_0 + \beta_1 \log Q_{t-1} + \beta_2 \log I_{t-1} + \beta_3 \log FA_{t-1} + \beta_4 \log \bar{p}_{t-1} + u_t \quad \text{.......... (4.3)}$$

Where:

| | | |
|---|---|---|
| Q | = | Quantity of maize produced |
| $\tilde{p}$ | = | Open market maize producer price |
| c | = | Transport cost (Fuel price) |
| r | = | Average fertilizer cost |
| FA | = | Total cereal food aid (in maize equivalents) |
| D | = | Rainfall - annual amount of precipitation. |
| | | 1 = normal year |
| | | 0 = drought year |
| LM | = | Land area planted to maize (ha) |
| I | = | Total commercial cereal imports (in maize equivalents) |
| $\bar{p}$ | = | Official maize producer price |
| $\varepsilon_t$ | = | Error term |
| $u_t$ | = | Error term |

The error term assumptions are similar to those of Tapio-Bistrom (2001). The estimation results will not be correct if the following Gauss Markov assumptions are not valid:

- Each of the stochastic disturbance terms have a zero mean (disturbance assumption);
- All stochastic disturbance terms have the same (finite) variance (homoscedasticity);
- Each pair of stochastic disturbance terms has zero covariance (absence of serial correlation);
- The disturbance term is independent of the exogenous explanatory variables; and

- The disturbance term is not independent of the endogenous explanatory variables.

The main purpose of stage one was to obtain a reduced form of the quantity function and price function as expressed in Equations (4.7) and (4.11). Stage one; however, was completed by fitting the first OLS on equations (4.7) and (4.11) to obtain equations (4.12) and (4.13), respectively. This process allowed for the elimination of the correlation likely to exist between quantity and price variables with their error terms, as pointed out in assumption five. Therefore, applying OLS on equations (4.12) and (4.13) gave consistent estimates of the parameters. The estimations were as follows:

Equation (4.3) leads to

$$\log \tilde{p}_{t-1} = \beta_0 + \beta_1 \log Q_{t-2} + \beta_2 \log I_{t-2} + \beta_3 \log FA_{t-2} + \beta_4 \log \bar{p}_{t-2} + u_{t-1} \quad (4.4)$$

Substituting (4.4) in (4.2) gives:

$$\log Q_t = \alpha_0 + \alpha_1\beta_0 + \alpha_1\beta_1 \log Q_{t-2} + \alpha_1\beta_2 \log I_{t-2} + \alpha_1\beta_3 \log FA_{t-2} + \alpha_1\beta_4 \log \bar{p}_{t-2}$$
$$+ \alpha_1 u_{t-1} + \alpha_2 \log r_t + \alpha_3 \log FA_{t-1} + \alpha_4 D_t + \alpha_5 \log LM_t + \alpha_6 \log c_t + \varepsilon_t \quad (4.5)$$

$$\log Q_t = \{\alpha_0 + \alpha_1\beta_0\} + \alpha_1\beta_1 \log Q_{t-2} + \alpha_1\beta_2 \log I_{t-2} + \alpha_1\beta_3 \log FA_{t-2} + \alpha_1\beta_4 \log \bar{p}_{t-2}$$
$$+ \alpha_2 \log r_t + \alpha_3 \log FA_{t-1} + \alpha_4 D_t + \alpha_5 \log LM_t + \alpha_6 \log c_t + \{\alpha_1 u_{t-1} + \varepsilon_t\} \quad (4.6)$$

$$\log Q_t = \hat{\prod}_{10} + \hat{\prod}_{11} \log Q_{t-2} + \hat{\prod}_{12} \log I_{t-2} + \hat{\prod}_{13} \log FA_{t-2} + \hat{\prod}_{14} \log \bar{p}_{t-2} + \hat{\prod}_{15} \log r_t$$
$$+ \hat{\prod}_{16} \log FA_{t-1} + \hat{\prod}_{17} D_t + \hat{\prod}_{18} \log LM_t + \hat{\prod}_{19} \log c_t + \hat{u}_t \quad (4.7)$$

Assumptions of ($\hat{u}_t$) were similar to assumptions 1, 2, 3 and 4 of the error term, and since equation (4.7) no longer had the endogenous variable ($\log \tilde{p}_{t-1}$), it meant ($\hat{u}_t$) was uncorrelated with the exogenous explanatory variables.

Equation (4.2) leads to:

$$\log Q_{t-1} = \alpha_0 + \alpha_1 \log \tilde{p}_{t-2} + \alpha_2 \log r_{t-1} + \alpha_3 \log FA_{t-2} + \alpha_4 D_{t-1} + \alpha_5 \log LM_{t-1} + \alpha_6 \log c_{t-1}$$
$$+ \varepsilon_{t-1} \quad (4.8)$$

Substituting (4.8) into (4.3) gives:

$$\log \tilde{p}_t = \beta_0 + \beta_1\alpha_0 + \beta_1\alpha_1 \log \tilde{p}_{t-2} + \beta_1\alpha_2 \log r_{t-1} + \beta_1\alpha_3 \log FA_{t-2} + \beta_1\alpha_4 D_{t-1}$$
$$+ \beta_1\alpha_5 \log LM_{t-1} + \beta_1\alpha_6 \log c_{t-1} + \beta_1\varepsilon_{t-1} + \beta_2 \log I_{t-1} + \beta_3 \log FA_{t-1} + \beta_4 \log \overline{p}_{t-1} + u_t \text{.......(4.9)}$$

$$\log \tilde{p}_t = \{\beta_0 + \beta_1\alpha_0\} + \beta_1\alpha_1 \log \tilde{p}_{t-2} + \beta_1\alpha_2 \log r_{t-1} + \beta_1\alpha_3 \log FA_{t-2} + \beta_1\alpha_4 D_{t-1}$$
$$+ \beta_1\alpha_5 \log LM_{t-1} + \beta_1\alpha_6 \log c_{t-1} + \beta_2 \log I_{t-1} + \beta_3 \log FA_{t-1} + \beta_4 \log \overline{p}_{t-1} + \{\beta_1\varepsilon_{t-1} + u_t\} \text{....(4.10)}$$

$$\log \tilde{p}_t = \hat{\prod}_{20} + \hat{\prod}_{21} \log \tilde{p}_{t-2} + \hat{\prod}_{22} \log r_{t-1} + \hat{\prod}_{23} \log FA_{t-2} + \hat{\prod}_{24} D_{t-1} + \hat{\prod}_{25} \log LM_{t-1}$$
$$+ \hat{\prod}_{26} \log c_{t-1} + \hat{\prod}_{27} \log I_{t-1} + \hat{\prod}_{28} \log FA_{t-1} + \hat{\prod}_{29} \log \overline{p}_{t-1} + \hat{u}_{2t} \text{.........................................(4.11)}$$

Therefore, fitting Ordinary Least Squares (OLS) on (4.7), gives:

$$\log \hat{Q}_t = \hat{\prod}_{10} + \hat{\prod}_{11} \log Q_{t-2} + \hat{\prod}_{12} \log I_{t-2} + \hat{\prod}_{13} \log FA_{t-2} + \hat{\prod}_{14} \log \overline{p}_{t-2} + \hat{\prod}_{15} \log r_t$$
$$+ \hat{\prod}_{16} \log FA_{t-1} + \hat{\prod}_{17} D_t + \hat{\prod}_{18} \log LM_t + \hat{\prod}_{19} \log c_t \text{.........................................................(4.12)}$$

Running OLS on (4.11), gives:

$$\log \hat{\tilde{p}}_t = \hat{\prod}_{20} + \hat{\prod}_{21} \log \tilde{p}_{t-2} + \hat{\prod}_{22} \log r_{t-1} + \hat{\prod}_{23} \log FA_{t-2} + \hat{\prod}_{24} D_{t-1} + \hat{\prod}_{25} \log LM_{t-1}$$
$$+ \hat{\prod}_{26} \log c_{t-1} + \hat{\prod}_{27} \log I_{t-1} + \hat{\prod}_{28} \log FA_{t-1} + \hat{\prod}_{29} \log \overline{p}_{t-1} \text{..................................................(4.13)}$$

In stage two, the estimated values of quantity and price were then substituted in the original equations before estimating the second OLS to obtain the final results. The specifications were as follows:

Substitute lagged (4.13) into (4.2) and lagged (4.12) into (4.3) to obtain;

$$\log Q_t = \alpha_0 + \alpha_1 \log \hat{\tilde{p}}_{t-1} + \alpha_2 \log r_t + \alpha_3 \log FA_{t-1} + \alpha_4 D_t + \alpha_5 \log LM_t$$
$$+ \alpha_6 \log c_t + u^*_{1t} \text{.................................................................................................................(4.14)}$$

And

$$\log \tilde{p}_t = \beta_0 + \beta_1 \log \hat{Q}_{t-1} + \beta_2 \log I_{t-1} + \beta_3 \log FA_{t-1} + \beta_4 \log \overline{p}_{t-1} + u^*_{2t} \text{..............................(4.15)}$$

Results obtained from stage two were then used to detect the effect of food aid, and other variables, on the quantity of maize produced (4.14) and maize producer price (4.15). The results are presented in Chapter 5.

# CHAPTER 5

# RESULTS AND DISCUSSION

## 5.1 Introduction

This chapter presents analytical results of the impact of food aid on maize production in Swaziland. The results provide answers to the following research questions:

- Does food aid lead to lower prices in the domestic maize market?
- Does food aid act as a disincentive to local maize producers such that the level of production is reduced in subsequent seasons?

First, an estimation of the country's maize production model is presented. This is followed by the impact of food aid on maize quantity produced and maize producer price at national level.

## 5.2 Estimation of a reliable country maize production model

Table 7 presents the Ordinary Least Squares (OLS) analytical results for determining the significance of the predominant maize market system in Swaziland using variables such as open market maize price, transport cost, average fertilizer cost, rainfall quantity and land area planted to maize.

The F-Statistic in the maize production function was found to be significant at the one percent level of probability with a goodness of fit ($R^2$) of 64%. The function showed no sign of serial correlation as the Durbin Watson (DW) statistic was 2.061. There was also no sign of multicollinearity amongst the explanatory variables as the variance inflation factor (VIF) for each variable was less than the critical value of 10 (Gujarati, 1995:339). From five explanatory variables that were included in the model, only rainfall emerged significant at the five percent level of probability.

**Table 7: Estimating the maize production function for Swaziland, 1985 – 2006**

| Variable | Unstandardised Coefficients | | Standardised Coefficients | t | Sig | Collinearity Statistics | |
|---|---|---|---|---|---|---|---|
| | B | Std.error | Beta | | | Tolerance | VIF |
| Constant | 8.808 | 3.651 | | 2.412 | 80.029 | | |
| Open market price lagged by one year | -0.430 | 0.227 | -0.361 | -1.892 | 0.078 | 0.664 | 1.506 |
| Average fuel price | 0.167 | 0.183 | 0.184 | 0.909 | 0.378 | 0.592 | 1.689 |
| Average fertilizer price | -0.254 | 0.326 | -0.155 | -0.780 | 0.448 | 0.615 | 1.626 |
| Rainfall | 0.217 | 0.087 | 0.451 | 2.511 | 0.024 | 0.751 | 1.332 |
| Amount of land planted to maize | 0.503 | 0.244 | 0.336 | 2.061 | 0.057 | 0.911 | 1.098 |
| **ANOVA** | | | | | | **Model Summary** | |
| **Model** | **Sum of Squares** | **df** | **Mean Square** | **F** | **Sig.** | $R^2$ | DW |
| Regression | 0.731 | 5 | 0.146 | 5.253 | 0.006 | 0.636 | 2.061 |
| Residual | 0.418 | 15 | 0.028 | | | | |
| Total | 1.149 | 20 | | | | | |

The results indicate that if the amount of rainfall received increases, the total harvest of maize in a particular production season is also likely to increase. However, the open market price lagged by one year and the amount of land planted to maize were significant at the 10% level of probability. The positive linear relationship between area planted to maize and maize produced is as expected. However, the negative coefficient of the lagged open market price is contrary to expectations. This may be due to the effects of frequent droughts experienced in Swaziland over the study period that led to declining maize quantity as a result of reduced yields and total area planted to maize

As the model was found to be statistically significant and with all variables, except for the open market price, showing coefficient signs in concurrence with *a priori* expectations, the production function was then used as a basis to formulate the reduced form model for analyzing the impact of food aid on the country's maize industry.

**5.3 Impact of food aid on maize quantity produced and maize producer price**

The impact of food aid on maize production in Swaziland was analysed by solving simultaneous equations (quantity function and price function) using a two-stage least squares (2SLS) method. In the 2SLS method, the analysis involved two successive applications of Ordinary Least Squares (OLS).

In stage one, OLS was applied to regress log $Q_t$ (equation 4.7) on all the pre-determined variables to obtain log $\hat{Q}_t$ (equation 4.12). OLS was also applied to regress log $\tilde{p}_t$ (equation 4.11) on all the predetermined variables to obtain log $\hat{\tilde{p}}_t$ (equation 4.13).

Tables 8 and 9 present results obtained from estimating equations (4.7) and (4.11) using OLS. As these were intermediate results, there was no need to interpret them at this stage. A full interpretation is given after fitting OLS in stage two.

**Table 8: OLS results for estimating maize quantity (Qt) in Swaziland, 1985 – 2006**

| **Variable** | **Unstandardised Coefficients** | | **Standardised Coefficients** | **t** | **Sig** | **Collinearity Statistics** | |
|---|---|---|---|---|---|---|---|
| | **B** | **Std.error** | **Beta** | | | **Tolerance** | **VIF** |
| Constant | 15.727 | 8.482 | | 1.854 | 0.113 | | |
| Commercial maize imports lagged by two years | -0.811 | 0.554 | -0.723 | -1.463 | 0.194 | 0.202 | 4.958 |
| Quantity of food aid lagged by two years | 0.019 | 0.102 | 0.078 | 0.190 | 0.856 | 0.293 | 3.407 |
| Official maize market price lagged by two years | -0.756 | 0.513 | -0.799 | -1.474 | 0.191 | 0.168 | 5.968 |
| Average fertilizer price | -0.375 | 0.656 | -0.215 | -0.572 | 0.588 | 0.349 | 2.867 |
| Quantity of food aid lagged by one year | -0.192 | 0.159 | -0.563 | -1.207 | 0.273 | 0.227 | 4.414 |
| Rainfall | 0.537 | 0.196 | 1.060 | 2.736 | 0.034 | 0.328 | 3.052 |
| Amount of land planted to maize | 1.203 | 0.546 | 0.880 | 2.192 | 0.071 | 0.305 | 3.277 |
| Average fuel price | -0.172 | 0.303 | -0.205 | -0.568 | 0.591 | 0.379 | 2.637 |
| **ANOVA** | | | | | | **Model Summary** | |
| **Model** | **Sum of Squares** | **df** | **Mean Square** | **F** | **Sig.** | $R^2$ | DW |
| Regression | 0.601 | 8 | 0.075 | 1.789 | 0.247 | 0.705 | 2.201 |
| Residual | 0.252 | 6 | 0.042 | | | | |
| Total | 0.854 | 14 | | | | | |

One variable, $Q_{t-2}$ was excluded when estimating the model using OLS as it showed a tolerance level of 0.00, hence providing a source of multicollinearity within the model. In the absence of $Q_{t-2}$, the model performed satisfactorily.

**Table 9: OLS results for estimating open market maize producer price ($\tilde{p}_t$), Swaziland, 1985 – 2006**

| **Variable** | **Unstandardised Coefficients** | | **Standardised Coefficients** | **t** | **Sig** | **Collinearity Statistics** | |
|---|---|---|---|---|---|---|---|
| | **B** | **Std.error** | **Beta** | | | **Tolerance** | **VIF** |
| Constant | 14.078 | 6.262 | | 2.248 | 0.074 | | |
| Open market price lagged by two years | -0.065 | 0.524 | -0.045 | -0.123 | 0.907 | 0.244 | 4.098 |
| Average fertilizer price lagged by one year | -1.150 | 0.560 | -0.699 | -2.053 | 0.095 | 0.280 | 3.578 |
| Quantity of food aid lagged by two years | -0.019 | 0.087 | -0.088 | -0.222 | 0.833 | 0.208 | 4.806 |
| Rainfall lagged by one year | 0.207 | 0.132 | 0.481 | 1.575 | 0.176 | 0.348 | 2.877 |
| Amount of land planted to maize lagged by one year | 0.765 | 0.349 | 0.620 | 2.192 | 0.080 | 0.406 | 2.464 |
| Average fuel price lagged by one year | 0.587 | 0.272 | 0.715 | 2.161 | 0.083 | 0.297 | 3.371 |
| Commercial maize imports lagged by one year | -0.901 | 0.295 | -0.971 | -3.162 | 0.025 | 0.344 | 2.906 |
| Quantity of food aid lagged by one year | 0.029 | 0.083 | 0.095 | 0.346 | 0.743 | 0.432 | 2.316 |
| Official market price lagged by one year | -0.553 | 0.421 | -0.578 | -1.313 | 0.246 | 0.168 | 5.967 |
| **ANOVA** | | | | | | **Model Summary** | |
| **Model** | **Sum of Squares** | **df** | **Mean Square** | **F** | **Sig.** | $R^2$ | DW |
| Regression | 0.554 | 9 | 0.062 | 2.870 | 0.129 | 0.838 | 2.970 |
| Residual | 0.108 | 5 | 0.022 | | | | |
| Total | 0.668 | 14 | | | | | |

The results obtained in stage one, where OLS was used to fit equations (4.7) and (4.11), gave the unstandardised coefficients for estimating $\hat{Q}_t$ and $\hat{\hat{p}}_t$ as shown in equations (4.12) and (4.13). Estimated quantity ($\hat{Q}_t$) was then substituted in the price function (4.14) and estimated price ($\hat{\hat{p}}_t$) was likewise substituted in the quantity function (4.15) and the two equations were then solved simultaneously to analyse the impact of explanatory variables, including food aid, on the quantity of maize produced and maize producer price.

Table 10 presents the results obtained when estimating the quantity function (4.14) after replacing the price with its estimate. This is the same function that analysed the impact of food aid, amongst other variables, on quantity of maize produced.

**Table 10: OLS results for analysing impact of food aid on quantity of maize produced, Swaziland, 1985 – 2006**

| **Variable** | **Unstandardised Coefficients** | | **Standardised Coefficients** | **t** | **Sig** | **Collinearity Statistics** | |
|---|---|---|---|---|---|---|---|
| | **B** | **Std.error** | **Beta** | | | **Tolerance** | **VIF** |
| Constant | 3.667 | 4.434 | | 0.827 | 0.446 | | |
| Estimated open market price lagged by one year | -1.432 | 0.512 | -1.002 | -2.796 | 0.038 | 0.202 | 4.941 |
| Average fertilizer price | 0.107 | 0.384 | 0.059 | 0.278 | 0.792 | 0.579 | 1.726 |
| Quantity of food aid lagged by one year | 0.220 | 0.092 | 0.580 | 2.377 | 0.063 | 0.438 | 2.285 |
| Rainfall | 0.056 | 0.166 | 0.112 | 0.334 | 0.752 | 0.231 | 4.338 |
| Amount of land planted to maize | 1.103 | 0.350 | 0.818 | 3.155 | 0.025 | 0.387 | 2.585 |
| Average fuel price | 0.527 | 0.213 | 0.561 | 2.469 | 0.057 | 0.503 | 1.988 |
| **ANOVA** | | | | | | **Model Summary** | |
| **Model** | **Sum of Squares** | **df** | **Mean Square** | **F** | **Sig.** | $R^2$ | DW |
| Regression | 0.622 | 6 | 0.104 | 5.576 | 0.040 | 0.870 | 2.890 |
| Residual | 0.093 | 5 | 0.019 | | | | |
| Total | 0.714 | 11 | | | | | |

The F-statistic of the maize quantity function was significant at the five percent level of probability with a goodness of fit of 87%. Although the DW appeared to be within the inconclusive range, the function, however, showed no sign of multicollinearity amongst the explanatory variables. From a total of six explanatory variables that were included in the model, only two emerged significant at the five percent level of probability namely, the estimated open market price, lagged by one year, and amount of land planted to maize. The coefficients of quantity of food aid (lagged by one year) and average fuel price were significant at the 10% level of probability.

If food aid had a negative impact on quantity of maize produced, the food aid variable would be significant and negative. However, evidence shown in Table 10 proved otherwise as the food aid variable emerged positive and significant at the 10% level of probability, which suggests that there is no significant negative relationship between quantity of maize produced and food aid received by Swaziland. Instead, this could mean that the reduction in local maize production increases the demand for food aid. As mentioned earlier, donor agencies have in recent years increased the procurement of local and regionally supplied food commodities to feed households in the affected areas. Consequently, farmers who are able to produce under the current drought conditions are taking full advantage of the situation, more so, since producer prices have increased substantially.

Table 11 presents the results obtained when using OLS on the price function (equation 4.15) after replacing the quantity of maize produced with its estimate. This is the same function that analysed the impact of food aid, amongst other variables, on maize producer price.

The F-statistic of the maize producer price function was not significant and the goodness of fit was 30.4% which is below the acceptable level of $R^2$ (Gujarati 1995:202; Koutsoyiannis, 1992:122). The function, though, showed no sign of multicollinearity amongst the explanatory variables as the variance inflation factor (VIF) for each variable was less than the critical value of 10. As the model itself was not significant, none of the explanatory variables were found to be significant, including the variable on quantity of food aid. The results, therefore, show that there is no significant relationship between food aid and maize producer price in Swaziland.

**Table 11: OLS results for analysing impact of food aid on maize open market producer price, Swaziland, 1985 – 2006**

| **Variable** | **Unstandardised Coefficients** | | **Standardised Coefficients** | **t** | **Sig** | **Collinearity Statistics** | |
|---|---|---|---|---|---|---|---|
| | **B** | **Std.error** | **Beta** | | | **Tolerance** | **VIF** |
| Constant | 10.173 | 5.337 | | 1.906 | 0.098 | | |
| Estimated quantity of maize lagged by one year | 0.687 | 0.730 | 0.578 | 0.941 | 0.378 | 0.264 | 3.793 |
| Commercial maize imports lagged by one year | -0.893 | 0.565 | -1.021 | -1.580 | 0.158 | 0.238 | 4.202 |
| Quantity of food aid lagged by one year | -0.097 | 0.117 | -0.302 | -0.830 | 0.434 | 0.754 | 1.327 |
| Official maize market price lagged by one year | -0.017 | 0.402 | -0.014 | -0.042 | 0.967 | 0.899 | 1.113 |
| **ANOVA** | | | | | | **Model Summary** | |
| **Model** | **Sum of Squares** | **df** | **Mean Square** | **F** | **Sig.** | $R^2$ | DW |
| Regression | 0.158 | 4 | 0.040 | 0.766 | 0.580 | 0.304 | 1.211 |
| Residual | 0.362 | 7 | 0.052 | | | | |
| Total | 0.520 | 11 | | | | | |

### 5.4 Improving the degrees of freedom

Recognising the low degrees of freedom in the analytical results, an attempt was made to eliminate variables with parameter estimates that were not significant at least at the 20% level of probability. Consequently, two variables, namely, average fuel price and average fertilizer price were eliminated at the first stage of the analytical process where the country's maize production function was determined. The original analytical framework was maintained, meaning the impact of food aid on maize quantity produced and maize producer price was analysed in the same format as in the first attempt but this time with the exclusion of average fuel price and average fertilizer price. The results obtained in the second attempt are presented below.

#### 5.4.1 Estimation of a reliable country maize production model

Table 12 presents the OLS analytical results for determining the significance of the predominant maize market system in Swaziland using the following variables: open market maize price, rainfall quantity and amount of land planted to maize.

The F-Statistic in the maize production function was found to be significant at the one percent level of probability with a goodness of fit ($R^2$) of 61%. The function showed no sign of serial correlation as the Durbin Watson (DW) statistic was 2.027. There was also no sign of multicollinearity amongst the explanatory variables as the variance inflation factor (VIF) for each variable was less than the critical value of 10. Out of the three explanatory variables, rainfall and land area planted to maize emerged significant at the five percent level of probability. As expected, the results indicate that if both the amount of rainfall received and area planted to maize increase, the total harvest of maize in a particular production season is also likely to increase. The negative coefficient of the lagged open market price, however, is contrary to expectations for reasons explained earlier.

**Table 12: Estimating the maize production function for Swaziland, 1985 – 2006 (after eliminating fuel price and fertilizer price)**

| Variable | Unstandardised Coefficients | | Standardised Coefficients | t | Sig | Collinearity Statistics | |
|---|---|---|---|---|---|---|---|
| | B | Std.error | Beta | | | Tolerance | VIF |
| Constant | 7.645 | 2.954 | | 2.588 | 0.019 | | |
| Open market price lagged by one year | -0.349 | 0.203 | -0.293 | -1.717 | 0.104 | 0.782 | 1.279 |
| Rainfall | 0.229 | 0.082 | 0.476 | 2.797 | 0.012 | 0.783 | 1.277 |
| Amount of land planted to maize | 0.539 | 0.226 | 0.361 | 2.384 | 0.029 | 0.992 | 1.008 |
| **ANOVA** | | | | | | **Model Summary** | |
| **Model** | **Sum of Squares** | **df** | **Mean Square** | **F** | **Sig.** | $R^2$ | DW |
| Regression | 0.705 | 3 | 0.235 | 9.003 | 0.001 | 0.614 | 2.027 |
| Residual | 0.444 | 17 | 0.026 | | | | |
| Total | 1.149 | 20 | | | | | |

As the model was found to be statistically significant and with all variables, except the open market price, showing coefficient signs in concurrence with *a priori* expectations, the production function was then used as a basis to formulate the reduced form model for analyzing the impact of food aid on the country's maize industry.

### 5.4.2 Impact of food aid on maize quantity produced and maize producer price

The impact of food aid on maize production in Swaziland was then analysed by solving simultaneous equations (quantity function and price function) using a two-stage least squares (2SLS) method. The same procedure was followed, as in the first attempt, but this time with the exclusion of average fertilizer price and average fuel price.

Tables 13 and 14 present results obtained from estimating equations (4.7) and (4.11) using OLS (with the exclusion of average fertilizer price and average fuel price). As these were intermediate results, there was no need to interpret them at this stage. A full interpretation is given after fitting OLS in stage two.

**Table 13: OLS results for estimating maize quantity (Qt) in Swaziland, 1985 – 2006 (after eliminating fuel price and fertilizer price)**

| **Variable** | **Unstandardised Coefficients** | | **Standardised Coefficients** | **t** | **Sig** | **Collinearity Statistics** | |
|---|---|---|---|---|---|---|---|
| | **B** | **Std.error** | **Beta** | | | **Tolerance** | **VIF** |
| Constant | 9.946 | 5.921 | | 1.680 | 0.132 | | |
| Commercial maize imports lagged by two years | -0.650 | 0.471 | -0.580 | -1.382 | 0.204 | 0.246 | 4.059 |
| Quantity of food aid lagged by two years | 0.004 | 0.075 | 0.016 | 0.052 | 0.960 | 0.481 | 2.080 |
| Official maize market price lagged by two years | -0.390 | 0.323 | -0.412 | -1.208 | 0.262 | 0.373 | 2.681 |
| Quantity of food aid lagged by one year | -0.107 | 0.123 | -0.316 | -0.871 | 0.409 | 0.331 | 3.025 |
| Rainfall | 0.454 | 0.167 | 0.896 | 2.708 | 0.027 | 0.396 | 2.526 |
| Amount of land planted to maize | 1.075 | 0.448 | 0.787 | 2.399 | 0.043 | 0.403 | 2.480 |
| **ANOVA** | | | | | | **Model Summary** | |
| **Model** | **Sum of Squares** | **df** | **Mean Square** | **F** | **Sig.** | $R^2$ | DW |
| Regression | 0.557 | 6 | 0.093 | 2.510 | 0.114 | 0.653 | 2.520 |
| Residual | 0.296 | 8 | 0.037 | | | | |
| Total | 0.854 | 14 | | | | | |

One variable, $Q_{t-2}$ was excluded when estimating the model using OLS as it showed a tolerance level of 0.00, hence providing a source of multicollinearity within the model. In the absence of $Q_{t-2}$, the model performed satisfactorily.

**Table 14: OLS results for estimating open market maize producer price ($\tilde{p}_t$), Swaziland, 1985 – 2006 (after eliminating fuel price and fertilizer price)**

| Variable | Unstandardised Coefficients | | Standardised Coefficients | t | Sig | Collinearity Statistics | |
|---|---|---|---|---|---|---|---|
| | B | Std.error | Beta | | | Tolerance | VIF |
| Constant | 3.170 | 8.377 | | 0.378 | 0.716 | | |
| Open market price lagged by two years | 0.903 | 0.488 | 0.628 | 1.850 | 0.107 | 0.678 | 1.475 |
| Quantity of food aid lagged by two years | -0.098 | 0.099 | -0.446 | -0.996 | 0.352 | 0.388 | 2.574 |
| Rainfall lagged by one year | 0.021 | 0.151 | 0.050 | 0.142 | 0.891 | 0.636 | 1.574 |
| Amount of land planted to maize lagged by one year | 0.240 | 0.470 | 0.195 | 0.512 | 0.624 | 0.539 | 1.857 |
| Commercial maize imports lagged by one year | -0.240 | 0.386 | -0.242 | -0.623 | 0.553 | 0.516 | 1.938 |
| Quantity of food aid lagged by one year | 0.017 | 0.130 | 0.057 | 0.131 | 0.900 | 0.417 | 2.398 |
| Official market price lagged by one year | -0.283 | 0.355 | -0.296 | -0.795 | 0.453 | 0.565 | 1.770 |
| **ANOVA** | | | | | | **Model Summary** | |
| **Model** | **Sum of Squares** | **df** | **Mean Square** | **F** | **Sig.** | $R^2$ | DW |
| Regression | 0.303 | 7 | 0.043 | 0.831 | 0.593 | 0.454 | 1.779 |
| Residual | 0.365 | 7 | 0.052 | | | | |
| Total | 0.668 | 14 | | | | | |

The results obtained in stage one, where OLS was used to fit equations (4.7) and (4.11), gave the unstandardised coefficients for estimating $\hat{Q}_t$ and $\hat{\tilde{p}}_t$ as shown in equations (4.12) and (4.13). Estimated quantity ($\hat{Q}_t$) was then substituted in the price function (4.14) and estimated price ( $\hat{p}_t$ ) was likewise substituted in the quantity function (4.15) and the two equations were then solved simultaneously to analyse the impact of explanatory variables, including food aid, on the quantity of maize produced and maize producer price.

Table 15 presents the results obtained when estimating the quantity function (4.14) after replacing the price with its estimate. This is the same function that analysed the impact of food aid, amongst other variables, on quantity of maize produced.

**Table 15: OLS results for analysing impact of food aid on quantity of maize produced, Swaziland, 1985 – 2006 (after eliminating fuel price and fertilizer price)**

| **Variable** | **Unstandardised Coefficients** | | **Standardised Coefficients** | **t** | **Sig** | **Collinearity Statistics** | |
|---|---|---|---|---|---|---|---|
| | **B** | **Std.error** | **Beta** | | | **Tolerance** | **VIF** |
| Constant | 1.013 | 4.341 | | 0.233 | 0.821 | | |
| Estimated open market price lagged by one year | -0.000 | 0.000 | -0.384 | -1.918 | 0.087 | 0.895 | 1.117 |
| Quantity of food aid lagged by one year | 0.067 | 0.088 | 0.184 | 0.762 | 0.466 | 0.619 | 1.617 |
| Rainfall | 0.269 | 0.104 | 0.523 | 2.583 | 0.030 | 0.876 | 1.141 |
| Amount of land planted to maize | 0.852 | 0.343 | 0.622 | 2.485 | 0.035 | 0.572 | 1.747 |
| **ANOVA** | | | | | | **Model Summary** | |
| **Model** | **Sum of Squares** | **df** | **Mean Square** | **F** | **Sig.** | $R^2$ | DW |
| Regression | 0.576 | 4 | 0.144 | 4.714 | 0.025 | 0.677 | 2.258 |
| Residual | 0.275 | 9 | 0.031 | | | | |
| Total | 0.851 | 13 | | | | | |

The F-statistic of the maize quantity function was significant at the five percent level of probability with a goodness of fit of 68%. The function showed no sign of serial correlation as the Durbin Watson (DW) statistic of 2.258 is within the desirable range. There was also no sign of multicollinearity amongst the explanatory variables as the variance inflation factor (VIF) for each variable was less than the critical value of 10. From a total of four explanatory variables that were included in the model, only two emerged significant at the five percent level of probability namely, rainfall and amount of land planted to maize. The quantity of food aid (lagged by one year) was not significant, whereas the estimated price was significant at the 10% level of probability.

If food aid had a negative impact on quantity of maize produced, the food aid variable would be significant and negative. However, evidence shown in Table 15 showed otherwise (as the food aid variable emerged positive and not significant), suggesting that there is no significant negative relationship between the quantity of maize produced and food aid received by Swaziland.

Table 16 presents results obtained when using OLS on the price function (equation 4.15) after replacing the quantity of maize produced with its estimate. This is the same function that analysed the impact of food aid, amongst other variables, on maize producer price.

The F-statistic of the maize producer price function was not significant and the goodness of fit was 33%, which is below the acceptable level of $R^2$ (Gujarati 1995:202; Koutsoyiannis, 1992:122). The function, though, showed no sign of multicollinearity amongst the explanatory variables as the variance inflation factor (VIF) for each variable was less than the critical value of 10. As the model itself was not significant, none of the explanatory variables were found to be significant, including the variable on quantity of food aid. The results, therefore, show that there is no significant relationship between food aid and maize producer price in Swaziland.

**Table 16: OLS results for analysing impact of food aid on maize open market producer price, Swaziland, 1985 – 2006 (after eliminating fuel price and fertilizer price)**

| **Variable** | **Unstandardised Coefficients** | | **Standardised Coefficients** | **t** | **Sig** | **Collinearity Statistics** | |
|---|---|---|---|---|---|---|---|
| | **B** | **Std.error** | **Beta** | | | **Tolerance** | **VIF** |
| Constant | 10.089 | 5.064 | | 1.992 | 0.087 | | |
| Estimated quantity of maize lagged by one year | 0.603 | 0.547 | 0.555 | 1.102 | 0.307 | 0.376 | 2.662 |
| Commercial maize imports lagged by one year | -0.807 | 0.451 | -0.922 | -1.789 | 0.117 | 0.359 | 2.788 |
| Quantity of food aid lagged by one year | -0.075 | 0.117 | -0.233 | -0.643 | 0.541 | 0.730 | 1.369 |
| Official maize market price lagged by one year | -0.031 | 0.394 | -0.026 | -0.079 | 0.939 | 0.896 | 1.116 |
| **ANOVA** | | | | | | **Model Summary** | |
| **Model** | **Sum of Squares** | **df** | **Mean Square** | **F** | **Sig.** | $R^2$ | DW |
| Regression | 0.173 | 4 | 0.043 | 0.870 | 0.527 | 0.332 | 1.308 |
| Residual | 0.347 | 7 | 0.050 | | | | |
| Total | 0.520 | 11 | | | | | |

## 5.5 Summary

The overall statistical analysis was constrained by the lack of more data as some degrees of freedom were lost in stage two of the 2SLS method. Nonetheless, the results of the 2SLS model revealed that food aid does not have a negative effect on both the quantity of maize produced and the maize producer price in Swaziland. In both attempts, the maize quantity function was significant, showing no serial correlation and no multicollinearity amongst explanatory variables. However, in the first attempt, the estimated food aid coefficient was positive and significant at the 10% level of probability, whereas in the second attempt, after improving the degrees of freedom, it was positive and not significant. The price function, on the other hand, was not significant in both attempts, hence the explanatory variables were also not significant. The available data set of 1985 – 2006 suggests that food aid does not have a negative impact on maize production and maize producer price in Swaziland. There is a high possibility that the food aid that comes into the country is received by food insecure households located in the areas severely affected by drought. Households located in the high rainfall areas and still have the capacity to produce, continue to do so without relying on food aid.

# CHAPTER 6

# CONCLUSIONS AND RECOMMENDATIONS

Maize is the staple food of Swaziland and occupies about 80% of the total area under crop production in the country. The objective of the study was to provide empirical evidence on whether food aid leads to depressed domestic maize prices and reduced maize production. Specifically, the study was aimed at providing evidence on whether food aid leads to lower prices in the Swaziland domestic maize market and whether food aid acts as a disincentive to local maize producers such that the level of production in Swaziland is reduced in subsequent seasons. This chapter presents a summary of findings, conclusions and policy recommendations that could be considered as a means towards reducing the likely effects of food aid on domestic agricultural production.

A two-stage least squares method (2SLS) was used to analyse the impact of food aid on maize producer price and quantity of maize produced. The study used secondary national data from 1985 to 2006. Variables used in the analysis included quantity of cereal food aid, quantity of commercial maize imports, quantity of locally produced maize, official maize producer price, open market maize producer price, fertilizer price, fuel price, rainfall and total area planted to maize. The impact of food aid was measured using the reduced form market equilibrium model that consisted of maize quantity and maize producer price functions estimated simultaneously using the above variables through the 2SLS method.

The overall statistical analysis was constrained by the lack of more data as some degrees of freedom were lost in stage two of the 2SLS method. However, an attempt was made to improve the degrees of freedom through the systematic elimination of variables with parameter estimates not significant at least at the 20% level of probability. The maize quantity function was significant, showing no sign of serial correlation and no multicollinearity amongst explanatory variables. The food aid variable was, however positive and not significant, meaning that food aid has no significant impact on maize production in the country. On the other hand, the price function was not significant, hence the explanatory variables were also not significant.

## 6.1 Conclusion

The results of the 2SLS model showed that food aid received by Swaziland does not have a negative effect on the quantity of maize produced in subsequent seasons. The results also showed that food aid received by Swaziland does not lead to lower prices in the country's domestic maize market.

The results could be justified by the fact that Swaziland's domestic food production has never matched domestic demand for food even in normal seasons. In the past, this did not have much effect as the country was able to reduce the food gap through commercial food imports, which people would access through household income generated through various means. Households located in the Lowveld, dry Middleveld, and part of the Lubombo Plateau produced cotton (under rainfed conditions). This cotton would be sold and returns used to buy food (maize) either from commercial outlets or directly from farmers in the high rainfall areas. Cotton is no longer a viable crop in the dry areas, mainly because of the current drought and very low returns to the producer. This has dramatically affected access to seasonal and casual employment opportunities that are critically important to the livelihoods of the poor in the Lowveld and dry Middleveld.

Households located in the Lowveld, dry Middleveld, and part of the Lubombo Plateau are now highly vulnerable to shocks such as drought, and are currently producing neither food crops nor cash crops, hence they are food insecure and rely heavily on food aid interventions.

The fact that Swaziland still receives commercial imports of maize grain and other food types proves that at the national level, the country has not yet developed a food aid "dependency syndrome". Households that are food secure do not benefit from food aid programmes since they are able to access food from commercial outlets or through own food production. The availability of food aid in the country has not gone beyond the threshold likely to disrupt the supply – demand balance. Therefore, in conclusion, it can be stated that food aid received by Swaziland over the study years has been correctly targeted because had the food aid been distributed to the food secure households, the demand for food from commercial outlets would have been reduced, leading to an adverse impact on maize producer prices, and subsequently local maize production.

## 6.2 Policy recommendations

Although the analytical results showed that food aid has no statistically significant effect on domestic maize production and maize producer price, Swaziland still faces a challenge in reducing the food sufficiency gap. This can be achieved, in part, by increasing local production, which will consequently reduce the need for food aid interventions.

The study, therefore, recommends the following national policy interventions that may be considered as a means of enhancing local agricultural production:

- There is a need for strengthening collaborative efforts between the public and private sectors in increasing investment in water infrastructure for the benefit of the rural majority. The current drought has brought into sharper focus the need to shift from rainfed agriculture to irrigated farming. This calls for an improved annual budget allocation for the agricultural sector (in line with regional and international declarations to which Swaziland is a signatory). Allocated funds will not only be used for irrigation development but also improving other complementary institutional support services such as research and extension, and capacity building for local farmers.

- The Swaziland Government needs to consider introducing commodity support programs such as, input subsidies or price support with the aim of boosting local agricultural production. However, this would need a thorough investigation prior to implementation in order to identify commodities that could be targeted for support and what impact this would have on the farmers, private sector and the macro economy.

- The lack of land rights to Swazi Nation Land (where 80% of local farmers produce) affects agricultural production as the land cannot be used as collateral by farmers willing to invest through borrowed capital. The draft Land Policy, which seeks to allow farmers on Swazi Nation Land a ninety nine year lease, has remained in draft form for the past seven years. This policy needs to be reviewed and adopted for immediate implementation.

- There is also a need to fully embrace the food security concept as opposed to food self-sufficiency. Food security at household level is mainly constrained by access to food, which is closely linked to household income. Therefore, sustainable pro-poor development programs are required along with appropriate safety nets. There is a need for a balanced mix of programs that address both the production of food and also raise the real incomes of the poor, hence increasing their access to food.

- In the event that the need for food aid continues to exist, support agencies should be encouraged to procure locally produced food commodities. This could be achieved if food dealers could provide food products at regionally competitive prices to support agencies. By so doing, the producer incentive in the country would not be lost as local producers, particularly those that have not been significantly affected by drought, would be guaranteed a reliable market.

- As part of a long-term strategy towards reducing the country's vulnerability to external shocks, Swaziland needs to formulate a comprehensive Disaster Preparedness Strategy Framework. The establishment of a National Disaster Preparedness Strategy Framework would contribute towards enhancing capacity for timely delivery of food supplies to affected populations during emergencies and minimizing disruptions on longer-term agricultural growth and development. The framework should be built on the following closely linked components:

- Swaziland does not have a strategic food reserve despite the fact that the country is highly vulnerable to disasters like drought, and storms. It is recommended that an exercise be undertaken to determine the necessity and effectiveness of establishing a national strategic grain reserve.

## 6.3 Recommendations for further research

The overall statistical analysis was constrained by the lack of more data as some degrees of freedom were lost in stage two of the two-stage least squares (2SLS) method. The study could be improved by increasing the number of years in the analysis in order to address the effect of reducing the degrees of freedom.

Another recommendation for further research would be to analyse the same data set using the Full Information Maximum Likelihood (FIML) to see how the results would compare with this study. The FIML method was used by Tapio-Bistrom (2001), from whom the methodology of this study was based.

As this study was based on national secondary data, there is a need for analysing the effects of food aid on food production at household level. The future study should also analyse the likely effects emanating from possible errors of inclusion and errors of exclusion in the food aid programme. Conclusions drawn from the household study would lead to the formulation of household – based policy interventions, which would go a long way in augmenting existing programmes, such as the newly drafted Poverty Reduction Strategy and Action Programme (PRSAP).

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**Appendix A: Data used for analysing the impact of food aid on maize production in Swaziland, 1985 – 2006**

| Year | Maize production (MT) | Area planted to maize (Ha) | Commercial maize imports (MT) | Cereal Food aid (MT) | Rainfall (mm) | Fuel (E/litre) | Wages (E/hr) | Fertilizer (E/50kg) | Maize price open market (E/ton) | Maize price official market (E/ton) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1984/85 | 85000 | 82553 | 24000 | 607 | 1 | 303.92 | 4.48 | 59.15 | 1,041.08 | 1,008.40 |
| 1985/86 | 85000 | 80561 | 21484 | 3049 | 0 | 207.49 | 6.54 | 53.46 | 1,013.57 | 929.19 |
| 1986/87 | 91000 | 63582 | 6974 | 7893 | 1 | 178.12 | 5.78 | 53.18 | 1,020.36 | 857.15 |
| 1987/88 | 89000 | 80340 | 27457 | 10028 | 1 | 167.41 | 5.07 | 51.00 | 1,020.40 | 786.03 |
| 1988/89 | 123196 | 84371 | 32060 | 2541 | 1 | 172.63 | 5.49 | 48.11 | 1,097.14 | 774.44 |
| 1989/90 | 84371 | 97433 | 16020 | 4841 | 0 | 187.39 | 5.09 | 69.17 | 997.80 | 657.09 |
| 1990/91 | 94173 | 83982 | 10770 | 2708 | 1 | 162.72 | 4.42 | 64.17 | 877.01 | 633.73 |
| 1991/92 | 53927 | 57330 | 9917 | 14975 | 0 | 142.86 | 4.58 | 57.99 | 1,205.94 | 649.35 |
| 1992/93 | 84519 | 63563 | 37072 | 24599 | 1 | 130.18 | 4.64 | 53.96 | 1,098.90 | 846.32 |
| 1993/94 | 76195 | 61585 | 5745 | 9766 | 0 | 119.44 | 4.90 | 50.92 | 853.11 | 662.32 |
| 1994/95 | 76052 | 59726 | 10352 | 6150 | 1 | 110.00 | 4.51 | 66.53 | 785.72 | 610.00 |
| 1995/96 | 135627 | 67447 | 23562 | 9500 | 1 | 165.85 | 5.13 | 65.70 | 700.97 | 595.82 |
| 1996/97 | 108207 | 60905 | 6767 | 0 | 1 | 170.93 | 5.55 | 65.08 | 652.92 | 554.97 |
| 1997/98 | 125204 | 65149 | 10106 | 5000 | 1 | 169.49 | 5.76 | 61.48 | 1,029.06 | 529.54 |
| 1998/99 | 107340 | 61051 | 30760 | 5000 | 1 | 176.80 | 5.44 | 59.99 | 914.28 | 520.00 |
| 1999/00 | 112779 | 76210 | 24812 | 0 | 1 | 218.61 | 7.76 | 67.27 | 773.04 | 505.05 |
| 2000/01 | 82536 | 64116 | 34911 | 0 | 1 | 239.95 | 7.21 | 66.49 | 1,148.99 | 502.68 |
| 2001/02 | 67639 | 60133 | 41307 | 15531 | 0 | 235.29 | 7.68 | 85.25 | 1,200.48 | 450.18 |
| 2002/03 | 69273 | 67682 | 24324 | 24200 | 0 | 206.94 | 7.15 | 69.45 | 1,358.26 | 419.46 |
| 2003/04 | 66862 | 54470 | 18641 | 12900 | 1 | 305.41 | 8.99 | 73.14 | 1,312.74 | 513.51 |
| 2004/05 | 74540 | 56265 | 18378 | 12100 | 0 | 247.16 | 8.58 | 62.69 | 1,253.13 | 490.20 |
| 2005/06 | 69210 | 47409 | 21000 | 9710 | 0 | 280.74 | 8.15 | 75.16 | 1,189.89 | 465.46 |

**Source.** The Ministry of Agriculture and Co-operatives, Ministry of Natural Resources and Energy, Central Statistics Office, Farm Chemicals, Swaziland Meteorological Service, National Maize Corporation, Food and Agriculture Organisation (FAO) and World Food Programme (WFP).

**Appendix B: Original data collected for analysing the impact of food aid on maize production in Swaziland, 1985 – 2006**

| Year | Rainfall (mm) | Fuel price (E/l) | Wages (E/hr | Average fertilizer price (E/50 kg) | | | Maize price (E/ton) | |
|---|---|---|---|---|---|---|---|---|
| | | | | Basal (NPK) | LAN | Av. Fertilizer price | Open market | Official market |
| 1984/85 | 825.52 | 93 | 1.37 | 20.35 | 12.86 | 18.10 | 318.57 | 308.57 |
| 1985/86 | 662.10 | 72 | 2.27 | 21.00 | 12.84 | 18.55 | 351.71 | 322.43 |
| 1986/87 | 896.54 | 70 | 2.27 | 23.90 | 13.90 | 20.90 | 401.00 | 336.86 |
| 1987/88 | 963.10 | 75 | 2.27 | 26.45 | 14.45 | 22.85 | 457.14 | 352.14 |
| 1988/89 | 794.12 | 82 | 2.61 | 26.45 | 14.45 | 22.85 | 521.14 | 367.86 |
| 1989/90 | 632.70 | 110 | 2.99 | 46.00 | 28.00 | 40.60 | 585.71 | 385.71 |
| 1990/91 | 832.62 | 110 | 2.99 | 48.90 | 30.50 | 43.38 | 592.86 | 428.40 |
| 1991/92 | 552.15 | 110 | 3.53 | 50.50 | 31.00 | 44.65 | 928.57 | 500.00 |
| 1992/93 | 796.98 | 110 | 3.92 | 51.00 | 33.00 | 45.60 | 928.57 | 715.14 |
| 1993/94 | 673.06 | 110 | 4.51 | 53.50 | 31.50 | 46.90 | 785.72 | 610.00 |
| 1994/95 | 779.07 | 110 | 4.51 | 75.35 | 45.95 | 66.53 | 785.72 | 610.00 |
| 1995/96 | 902.85 | 169 | 5.23 | 77.50 | 42.35 | 66.95 | 714.29 | 607.14 |
| 1996/97 | 992.86 | 187 | 6.07 | 79.45 | 51.95 | 71.20 | 714.29 | 607.14 |
| 1997/98 | 1032.51 | 200 | 6.80 | 83.50 | 47.00 | 72.55 | 1,214.29 | 624.86 |
| 1998/99 | 850.19 | 221 | 6.80 | 85.70 | 50.00 | 74.99 | 1,142.86 | 650.00 |
| 1999/00 | 1588.96 | 303 | 10.75 | 103.20 | 70.00 | 93.24 | 1,071.43 | 700.00 |
| 2000/01 | 908.46 | 358 | 10.75 | 110.47 | 72.94 | 99.21 | 1,714.29 | 750.00 |
| 2001/02 | 549.61 | 392 | 12.79 | 166.90 | 84.00 | 142.03 | 2,000.00 | 750.00 |
| 2002/03 | 565.78 | 370 | 12.79 | 137.75 | 92.50 | 124.17 | 2,428.57 | 750.00 |
| 2003/04 | 754.39 | 565 | 16.63 | 150.00 | 101.00 | 135.30 | 2,428.57 | 950.00 |
| 2004/05 | 565.94 | 479 | 16.63 | 132.00 | 97.00 | 121.50 | 2,428.57 | 950.00 |
| 2005/06 | 695.28 | 573 | 16.63 | 166.00 | 124.00 | 153.40 | 2,428.57 | 950.00 |

**Source.** The Ministry of Agriculture and Co-operatives, Ministry of Natural Resources and Energy, Central Statistics Office, Farm Chemicals, Swaziland Meteorological Service and National Maize Corporation.